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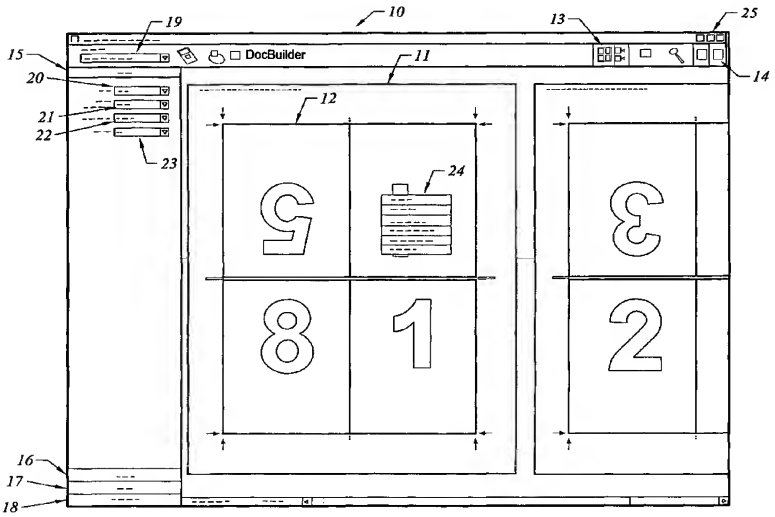

(57) Abstract: A process for formatting printable information orders selected data objects, document pages or images, to create a new document, where pages may be of uniform dimension and page orientation or varying in one or both of dimension and page orientation. Groups of pages are imposed on sheets so that the sequence of the printed pages matches the page sequence of the created document after post-printing processing. A method of imposing the differently shaped and sized printable pages on sheets divides an image of a sheet into separate slots and places a page into each slot by placing an image of the page in each slot. Alignment, offset and scaling settings are applied to individual slots, rows, columns or all slots. A variety of other layout and job options are set before printing. In a distributed system, the software, accessible from any workstation, is housed on a server.

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PROCESS AND SYSTEM FOR MIXED PAGE IMPOSITION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority from U.S. Provisional Patent Application Serial No. 60/283,816 filed April 13, 2001, entitled "Mixed Page Imposition."

BACKGROUND OF THE INVENTION

The invention relates generally to methods and systems for printing computer-generated images. More particularly, the invention relates to methods and systems for assembling and formatting documents in preparation for printing.

STATE OF THE ART

In print shop environments, content from multiple sources is often merged to create a new document. For example, in the production of an illustrated calendar, photographs may be scanned to produce the calendar illustrations. The scans are then interleaved with calendar pages, which may have been produced in a page layout program or a word processor. Generally, before the document is output to a color printer, additional layout and job options are specified, such as single-side vs. duplex printing, resolution, color profile and print profile. In particular, page imposition, in which selected individual pages are imposed on a single sheet, is an extremely useful layout option. The individual pages are arranged on the sheet to yield a proper page sequence in the finished document. Page imposition greatly facilitates post-printing processes such as collating, cutting, and binding, so that a printed document with the pages in the correct order results.

Various methods and systems for page imposition are known. For example, D. Stone, R. Hohensee, J Marlin, *Enhanced page placement for multiple-up presentation*, U.S. Patent No. 5,768,488 (June 16, 1998) describe a page placement process that enables user-defined placement of pages in an N-up environment. L. Holt, *Operating system with object-oriented printing interface*, U.S. Patent No. 5,495,561 (February 27, 1996) describes an object-oriented printing interface having a page imposition feature. C. Benson, *Imposition in a raster image processor*, U.S. Patent No. 6,046,818 (April 4, 2000) describes a method for imposing and rendering a plurality of non-overlapping pages to be printed on a single sheet. Any of these examples would be well suited for

producing a document such as the calendar described above, in which all of the pages to be imposed are of the same size and page orientation. However, all suffer the common limitation of being unable to impose pages of varying sizes and page orientations.

Thus, there remains a need in the art for a process for imposing pages of varying sizes and orientations. It would be a significant advance to implement such process as a server-based software application in a network environment, enabling the user to perform the various steps of the imposition process in any software application, from any workstation on the network, and to output the finished print job to any print device on the network. It would also be desirable to furnish other advanced layout features, such as negative gutter size, customizable trim and fold marks, and specification of binding options.

SUMMARY OF THE INVENTION

In recognition of such need, there is herein described an invention that provides methods and processes for formatting printable information in which data objects, generally images or pages from digital documents, are selected and ordered in such a way as to create a new digital document comprising a number of printable pages. The printable pages may be of uniform dimension and page orientation or they may vary in one or both of dimension and page orientation. Prior to printing, groups of printable pages are imposed on printable sheets in a manner such that the sequence of the printed pages matches the page sequence of the created digital document after post-printing processing steps such as folding, cutting, collating and binding.

One embodiment of the invention provides a method of imposing printable pages, the pages varying in one or both of dimension and orientation, on printable sheets, by means of a graphical user interface, in which a thumbnail image of a printable sheet is divided into separate slots. A printable page is placed into each slot by placing a thumbnail image of the printable page into the slot. Alignment, offset and scaling settings can be applied to individual slots, groups of slots or every slot on a sheet. Thereafter, a variety of other layout and job options are set prior to printing the document.

The invented methods and processes are implemented as a server-based software application in a distributed printing environment. Furthermore, the invention is also embodied as a computer program product for performing the invented methods and processes.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block diagram of a system for formatting printable information according to the invention;

Figure 2 shows a graphical user interface (GUI) of a page imposition application in preview mode according to the invention;

Figure 3 shows the GUI of Figure 2 in layout mode according to the invention;

Figure 4 shows a page mode selector from the GUI of Figure 2 according to the invention;

Figure 5 shows a 'Layout' pull down menu from the GUI of Figure 2 according to the invention;

Figure 6 shows a list box for defining printer's marks from the pulldown menu of Figure 5 according to the invention;

Figure 7 shows a view of a 'Scale' pulldown menu in Fixed page mode from the GUI of Figure 1 according to the invention;

Figure 8 shows a view of a 'Scale' pulldown menu in Mixed page mode from the GUI of Figure 2 according to the invention;

Figure 9 shows a 'Finishing' menu from the GUI of Figure 2 according to the invention;

Figure 10 provides a diagram of a technique for gang printing according to the invention;

Figure 11 shows a drop down menu for managing sheets from the GUI of Figure 2 according to the invention;

Figures 12-19 are screen shots showing an example of a brochure having a spread according to the invention; and

Figure 20 shows the placement of pages within slots according to the invention.

DETAILED DESCRIPTION

The invention provides a network-based system and method for formatting printable information. A particular embodiment of the invention provides a method of imposing groups of printable pages on printable sheets prior to output of a print job to a printing device. Page imposition is a technique for ordering the pages that make up a document on sheets in such manner as to facilitate organizing the pages of the final printed document into the correct page sequence using post-printing processing techniques such as folding, cutting, collating and binding.

Figure 1 shows a network-based system for formatting printable information. The system includes a server 91, any number of workstations 92 connected to the server, and one or more output devices 93, also connected to the server. At the workstation 92, users create a variety of data objects, which are subsequently selected and organized into a variety of digital documents. These data objects, typically pages created with word-processing or page layout programs; or images created with graphics programs may exist in a large number of formats. Furthermore, they may be stored locally on the workstation or they may be stored on the server. For purposes of organizing into digital documents, however, the data objects are converted to a common file format and stored on the server, as a library of data objects 94. The common file format is a page description language. The current embodiment of the invention uses PORTABLE DOCUMENT FORMAT (PDF), originally developed by Adobe Systems, Inc. of San Jose CA. Alternatively, other page description languages may be used, such as POSTSCRIPT, also developed by Adobe Systems, Inc. or PCL, developed by Hewlett-Packard Co. of Palo Alto CA.

To select from the library of objects, thumbnail images of the objects, also stored on the server, are displayed on the workstation, and the user interacts with the thumbnail images, using a pointing device such as a mouse to select and arrange the desired

objects. A page imposition application 95, resident on the server, and accessed by the user by means of a GUI 10 residing on the workstation 92, allows the user to perform page imposition and other layout and pre-print processing techniques to the print job before it is finally sent to the output device 93. In the current embodiment, the output device is either a color printer or a color copier programmed to function as a printer. However, the output device may, in fact, be any device having a print engine. In professional printing environments, high performance output devices may automatically perform post-printing techniques such as folding, cutting, collation and binding under the control of software programs residing on the server. While the system has been described as including one server, the system may actually include more than one server, with each server performing a dedicated function. For example, the object library may be archived on a file server, and the software application may reside on an application server.

Referring now to Figure 2, shown is the GUI 10 in preview mode, resident on the workstation 92, by which the user gains access to the imposition application 95. The user makes use of the application's various functionalities by activating the corresponding elements of the interface. In preview mode, a typical windowed workspace displays thumbnail images of the pages 12 of a print job on one or more printable sheets 11. Thus, the source file for a job may be modified by manipulating the page images in either preview mode, as shown in Figure 1, or layout mode, as shown in Figure 2. The pages 12 appear on the sheet 11 as a printer's spread, in the order in which they are to be printed as an imposed print job. Each sheet is divided into a number of 'slots,' or sections, each one intended to receive a page. The printable pages may include one or both of document pages and images. The various imposition attributes may be specified manually by interacting with the various interface elements and controls described below, or automatically through the application of a template. Templates are selected from a pulldown menu of templates 19. The user may specify a particular set of imposition attributes and then save the attribute set to a custom template for application to multiple print jobs, or the user may select from a number of built-in templates provided by the invention.

PAGE MODES

Advantageously, the invention is able to impose pages of varying size and shape in addition to conventional page imposition, in which pages of fixed size and orientation are imposed. Accordingly, a page mode selector 13 is provided for selecting either of:

- Fixed page mode, for uniform pages; and
- Mixed page mode, for pages that vary in dimension and/or orientation.

The "*mixed page mode*," apart from handling documents with pages of different dimensions, also enables a user to alter various imposition attributes for each page in the document separately. This facilitates the creation of many useful impositions. A duplexed brochure having a spread as described below is one such example. Many of these impositions can be stored as templates to be applied to different documents later. The construction of such impositions is not possible under the restriction that all the pages be of the same size.

Figure 2 shows Fixed page mode selected and Figure 3 shows Mixed page mode selected. As explained below, each mode offers a distinct array of user-settable imposition attributes, although there is considerable overlap between attribute arrays for the two page modes. Figure 4 provides a detailed view of the various settings available in the page mode selector. As indicated at 13a, fixed page mode is the default mode for a job containing pages of fixed size and orientation. Reference numeral 13b denotes fixed page mode. It will be appreciated that, for a fixed page job, the user is allowed to switch between modes. As shown at 13b, for a mixed page job, only the mixed page mode is available. In this case, the selector for fixed page mode is grayed-out.

VIEW MODES

View mode selector buttons 14 allow the user to switch between preview and layout modes. Preview mode approximates the appearance of the final printed output very closely, imposing thumbnail images of the pages on the sheet. Layout mode, shown in Figure 3, displays numbered, generic pages 12 that allow the user to determine location of source document pages in the imposed job.

IMPOSITION SETTINGS

Imposition settings apply to the job currently displayed in the main window. Because the imposition settings usually affect the job's printed layout, they are saved with the job and used whenever the job is opened. Changes to imposition settings are applied to the job in real time, but are not saved permanently until the job is saved. The various imposition attributes are organized according to category, the categories being:

- **Sheet**, which allows specification of paper characteristics on which the job is to be printed;
- **Layout**, which specifies number, ordering and rotation of pages on a sheet;
- **Scale** to enlarge or shrink pages by specified amounts, and to specify positioning within a slot; and
- **Finishing**, for specifying binding and gang printing settings.

Access to the attribute settings is gained through a series of pulldown menus 15, 16, 17 and 18, one menu provided for each category of attributes.

Table 1, below, provides a listing of the various imposition attributes, organized by category, along with an indication of which page mode the attribute is associated with, and usage constraints.

Table 1

FEATURES	FIXED PAGE MODE	MIXED PAGE MODE
Sheet		
Size	Yes	Yes
Creep Adjustment	Yes	Yes
Orientation	Yes	Yes
Duplex	Yes	Yes
Layout		
Row/Columns	Yes	Yes
Printer's Marks	Yes	Yes
Printer's Marks customizable	Yes	Yes
Pull in to page edge	No	Yes
Bleeds	Yes	No
Bleeds Definable	Yes	No
Scaling		
Apply to	Not editable • All slots on surface	Editable • Current Slot • Row on all surfaces • Column on all surfaces

FEATURES	FIXED PAGE MODE	MIXED PAGE MODE
		• All slots on all surfaces
Scale Mode	Editable • Scale to fit • Custom	Editable • Scale to fit • Custom • Fit width • Fir height
Scale Factor/Finish Height and Width	Disabled when under: • Scale to fit mode Enabled when: • Custom mode	Disabled when under: • Scale to fit • Fit width • Fit height Enabled when under: • Custom
Alignment/Offsets	Disabled	Disabled when under: • Scale to fit Enabled when under: • Custom • Fit width • Fit height
Finishing		
Binding	Yes	Yes
Gang Up	Yes	Yes
Drop Menu		
Add sheets	Yes	Yes
Duplicate Sheet	Yes	Yes
Delete Sheet(s)	Yes	Yes
Edit Page	Yes	Yes
Preview Mode		
Negative Gutter Size	Yes	Yes
Page Rotation	180 Deg increment	90 Deg increment

Each attribute will be discussed in greater detail below.

In Figure 2, the 'Sheet' menu 15 is shown pulled down to reveal a lower level of menus for the various 'Sheet' attributes:

- Size (20);
- Sheet (21);
- Orientation (22); and
- Duplex (23).

Because 'Sheet' settings affect virtually every other aspect of the imposition process, it is preferable that they should be specified immediately upon opening a job in the main window. 'Size' allows specification of sheet size. A number of built-in sheet sizes are

provided, or the user can specify a custom sheet size. 'Creep adjustment' provides either 'plain' or 'thick' settings, or the user can specify a thickness value from 0 – 2" (or the equivalent in another unit of measurement). 'Orientation' allows the user to rotate the sheet, either 90° or 180°. Setting 'Duplex' to 'on' specifies double-sided printing, setting it to 'off' specifies single-sided printing.

Figure 5 shows the 'Layout' menu 16 pulled down to reveal the various features available. 'Rows' and 'Columns' allow the number of rows and columns 31 in a sheet layout to be specified, each to a maximum of five per sheet. As illustrated, the settings specify a sheet with four pages imposed, two rows by two columns. Buttons for defining printer's marks 31 and bleeds 32 are provided. As indicated in Table 1, the 'Bleeds' feature is available only in Fixed page mode. By selecting the printer's marks button 31, the user is granted access to screen #2 (36) through which the user is able to set properties for trim marks and fold marks. A text box 35 allows values to be entered specifying horizontal and vertical offsets, thus altering the default placement of the trim and fold marks. Buttons 34 grant access to screen #3 (40) and screen #4 (41) (See Fig. 6) for setting trim and fold mark properties, respectively. Referring to screen #3, the user specifies trim marks properties as follows

- Horizontal length (42);
- Vertical length (43);
- Line type (44);
- Line width (45); and
- Line color (46).

The controls in Screen #4, for fold marks operate in the same manner. In either screen #3 or #4, the user may select line color from a chart of selections 47, or a 'Other' button 48 grants access to a further screen (not shown) having a color matrix for specifying a custom color.

Figure 7 shows the 'Scale' menu 17 pulled down in Fixed page mode. As previously described, the page mode is selected by means of the page mode selector 13. In Fixed page mode, the 'Apply to' field 51 is disabled; scaling settings are automatically applied to all pages on all surfaces in Fixed page mode. As Table 1 shows, in Fixed page mode, two scale modes 52 are available: 'Scale to fit' and 'Custom.' Here, 'Scale to fit' is

selected. When the custom scale mode is selected, Scale Factor 55, Original/Finished Height and Width 56, 57, disabled under 'Scale to fit' mode are enabled. However, the values for Scale Factor, Original/Finished Height and Width are proportionally constrained. Thus, when the user enters data in one field, values for the other two fields are automatically calculated, based on the entered value. While it is possible to supply values that would cause the page image to extend beyond the slot, the image would be clipped, specified by a clipping icon (not shown). In Fixed page mode, alignment 54 and offset 53 are disabled. Default values are automatically applied.

Figure 8 shows the 'Scale' menu 17 as it appears in Mixed page mode. Unlike Fixed page mode, scaling parameters can be applied to individual slots or groups of slots. The options available from the menu in the 'Apply to' field 51 include:

- Current slot;
- Row on all surfaces;
- Column on all surface; and
- All slots on all surfaces.

All four options are available at any time, regardless of scale mode selected.

Scale modes 52 available include:

- Scale to fit;
- Custom;
- Fit width; and
- Fit height.

'Scale to fit' is the default mode, wherein all pages are scaled to best-fit within the slots. Since the job may contain pages of varying size, the scale factor 55 may vary, although it cannot be edited. To view the scale factor for a particular page, the user can specify the page by selecting the corresponding slot in either layout or preview mode. The user may switch between scale modes at any time. However, when switching to 'Scale to fit,' any previous scale mode settings are discarded. Alignment 54 and Offsets 53 are not editable under 'scale to fit.'

In Mixed page mode, with the 'Custom' scale mode 51 selected, the user is free to enter Scale Factor 55, and Original/Finished Height and Width 56, 57. As in Fixed page mode, these settings are proportionally constrained, so that when a user enters data in one field, the other fields are automatically adjusted. Alignment 54 and Offset 53 are enabled. Using Alignment 54 the user can align a page within a slot with the following settings:

- Upper-Left
- Upper-Center;
- Upper-Right;
- Center-Left;
- Center-Center;
- Center-Right;
- Lower-Left;
- Lower-Center; and
- Lower-Right.

Using Offset 53, the page placement can be further adjusted, using the current Alignment position as the starting point for the offset. If Alignment settings change, the Offset values return to zero.

In Mixed page mode, with the 'Fit Width' scale mode 51 selected, the page width is scaled to best-fit the slot. Scale Factor, and Finished Height and Width are calculated based on slot width and Original Width. Alignment and Offsets are available.

In Mixed page mode, with the 'Fit Height' scale mode 51 selected, the page height is scaled to best-fit the slot. Scale Factor, and Finished Height and Width are calculated based on slot height and Original Height. Alignment and Offsets are available.

Figure 9 shows two separate views of the 'Finishing' pulldown menu 18. Using the 'Finishing' pulldown, the user specifies Binding and Gang printing options. As the first view shows (Fig. 9a), enabling Binding options 61 disables Gang up options 63. Binding options 61 include:

- Saddle;

- Nested Saddle; and
- Perfect.

In addition, the user specifies a binding edge 62. 'Left' is selected for a document that reads from left to right. 'Right' is selected for a document that reads from right to left, for example those written in Asian or middle-Eastern languages.

As shown in the second view of Figure 9 (Fig. 9b), enabling Gang Up options 63, disables Binding options. In Gang printing, multiple pages are placed on a sheet for 'collate and cut' finishing rather than imposing them in an order required for a particular binding method. The following Gang up methods are available:

- **Repeat** – places multiple copies of a page on a sheet until the sheet is filled. For example, the front side of sheet one is filled with images of page 1, the rear side is filled with images of page two, the front side of sheet two is filled with images of page 3, and the rear side with images of page four, etc.
- **Unique** – places the pages in an appropriate order for printing a single copy of a job. This option does not fully collate itself, thus requiring hand collation, but it optimizes sheet size while limiting the run to a single copy.
- **Unique-Collate Cut** – (Shown in Figure 10) places pages in arrangement that allows the page to fall into the correct order when the sheets are folded, stacked and cut. This option minimizes the necessity of collating by hand and is most appropriate for printing single copies of a document.

TEMPLATES

As mentioned earlier, the user may specify imposition settings for a job by applying a predefined template. Settings that can be saved to a template include but are not limited to:

- Page orientation;
- Single-sided or double-sided printing;
- Rows and columns
- Printer's marks 'on' and 'off';

- Job label;
- Bleeds 'on' and 'off';
- Bleed definition;
- Scale mode – 'Scale to fit';
- Scale mode – 'Fit width';
- Scale mode – 'Fit height';
- Alignment;
- Binding method;
- Binding edge;
- Group of;
- Gang up method;
- Gutter size;
- Page rotation; and
- Page numbering.

In addition to user-specified custom templates, the invention provides a number of built-in templates, including but not limited to:

- 1-up full bleed;
- 2-up perfect;
- 2-up saddle;
- 3-up trifold brochure;
- 4-up gate fold;
- 4-up head to head; and
- 4-up z-fold.

ADDING, DUPLICATING AND DELETING SHEETS

A drop down menu 24 is accessed by clicking the right mouse button in any layout or preview area. Figure 11 shows detailed views of the dropdown menu 24. The dropdown provides the following options:

- Zoom in;
- Zoom out;
- Add sheets;
- Duplicate sheet; and

- Edit page.

'Zoom in' and 'Zoom out' are conventional magnification features commonly provided in desktop applications. 'Add sheets' allows the user to add one or more new sheets to the print job as shown in the dialog box 81. The sheet or sheets may be added at the beginning, the end or at another user-selected point in the sheet sequence. 'Duplicate sheet,' as shown in the dialog box 82, allows the user to duplicate an existing sheet and add it to the print job at the beginning, the end or at another user-selected point in the sheet sequence. 'Delete sheet,' as shown in the dialog box 83, allows the user to select one or more sheets and delete them from the job. 'Edit page' allows the user to apply late edits to individual pages prior to printing.

GUTTER SIZE

The invention automatically governs the locations of gutters according to the layout and sheet size governing imposition for the job. The user can also specify gutter size by entering a value in its vertical gutter size field 26 or its horizontal gutter size field 27. It is also possible to specify a negative gutter value, for example, to join together two pages located in adjacent slots, or to offset the effect of an excess bleed value.

Imposition settings and any other job modifications are saved by activating the 'Close' button 24 on the window.

The invented methods and processes are implemented using conventional programming techniques known to those skilled in the art of computer programming.

Example: A Brochure having a spread

The steps outlined below create a four page, duplexed brochure containing two inner pages and a cover consisting of a single continuous image spread across two pages.

Required Document: A PDF document having three pages; where the third page (cover page) is twice the size of the first two pages, (inner pages) *e.g.* a file with two letter size pages and one 11 x W 17 cover page.

Steps :

a. Impose the document, the mode is automatically switched to *"Mixed page mode,"* as the document contains pages of different sizes.

b. Click on the *"Finish Tab"* to make sure that the setting is set to *"Gang-up-unique."*

c. From the "Sheets" settings choose the following (Figure 12)

- Sheet: Letter
- Orientation: Landscape
- Duplex: On

d. From the *"Layout"* tab choose (Figure 13)

- Row: 1
- Column 2
- Do not choose Printer's Marks and bleed settings.

e. Click on the preview mode and go to the sheet containing the Cover page. Notice that the cover page is on the left slot of the sheet with the other slot being empty. Now switch to the *"Layout mode"* by clicking on the *"Preview/layout"* button.

f. In the *"Layout mode"*, select the slot containing empty page (slot with "0"). Change the page number to be 3, which is the page number of the Cover Page. (Figure 14)

g. Go Back to the *"Preview mode"*. Now the sheet shall contain two copies of the cover page in both slots. (Figure 15)

h. Click on the *"Scale tab"*. Select the slot containing the inner page and note the scale factor. (Figure 16)

i. Select the left slot of the sheet containing the cover page on both the slots. Change the scale mode to custom. Enter the previously noted scale factor. Use the "Alignment matrix button" to set alignment to *"Left-Center"*. (Figure 17)

j. Repeat the step above on the right slot with the alignment set to "*Right-Center*". (Figure 18)

The final imposition is shown in Figure 19.

AN ALGORITHM FOR PLACING PAGES WITH DIFFERENT DIMENSIONS ON A SHEET ACCORDING TO A LAYOUT

As previously described, "**Mixed Page Mode**" provides for imposing documents with different page sizes on a Sheet according to a specified layout, *i.e.* number of "**rows**" and "**columns**". The idea behind the technique is to divide the sheet into "slots" and then place a page in each of the slot. The following discussion describes the general algorithm used for this purpose.

The inputs for this algorithm are the size of the sheet, the page sizes of the document to be imposed (which may be different for each page) and the number of rows and columns in which to place the pages, along with other parameters such as the gaps, mark lengths, and binding.

The algorithm can be better understood with the help of the following concepts:

- **ImageAble Sheet :** This is the actual area of the sheet where the pages are placed.
- **Slots :** These are the sections in which the sheet is divided into; the pages of the document are placed into these slots. The number of such slots would be the product of the number of rows and the number of columns and each slot of the sheet shall be of the same size.
- **SlotScaleX :** This is the ratio between the width of the slot and the width of the sheet i.e. slotWidth/sheetWidth.
- **SlotScaleY :** This is the ratio between the height of the slot and the height of the sheet i.e. slotHeight/sheetHeight.
- **PageScale:** This is the reduction applied to the original page in the document before placing it on the sheet; the final size of the placed page is the original page size times the PageScale (Since the ratio between the width and the height of the page can't be changed, we need only one scale).

The actual algorithm consists of the following four steps:

- The calculation of the SlotScales.
- The calculation of the PageScales for each page.
- The determination of where the slots are on the sheet
- The placement of pages within the slots.

The calculation of the SlotScales

To do this, first the "ImageAble Sheet" is calculated by decreasing from the sheet size the dimensions of the printer marks as required and the gaps specified by the imposition parameters. The width of the slot is then calculated by dividing the width of the "ImageAble Sheet" by the number of columns and the length of the slot by dividing the length of the "ImageAble Sheet" by the number of rows; the ratios follow naturally.

Pseudo code (implementation details omitted):

Input :

W	the width of the sheet
H	the height of the sheet
M_l	the margins on the left (this includes the mark dimensions)
M_r	the margins on the right (including the mark dimensions)
M_t	the margins on the top(including the mark dimensions)
M_b	the margins on the bottom(including the mark dimensions)
r	number of rows
c	number of columns
G_v	array 1...c-1 of Vertical Gaps(Gaps between columns)
G_h	array 1...r-1 of Horizontal Gaps(Gaps between rows)

Output :

S_x	SlotScaleX
S_y	SlotScaleY

Algorithm:

$$S_y = ((H - M_t - M_b - \sum_{i=1}^{i=r-1} G_h[i])/r)/H;$$

$$S_y = ((H - M_t - M_b - \sum_{i=1}^{i=r-1} G_h[i])/r)/H;$$

return $\{S_x, S_y\}$

The calculation of the PageScales for each page

The calculation has to be done per page as each page can have different size and therefore a different scale; remember that the slots in which the pages are placed are of the same size for each page. To do this, first the width of the slot is divided by the width of the page, then the height of the slot is divided by the height of the page and the minimum of the two ratios is considered as the page scale; the slot width and slot height are easily got after the first step.

Pseudo code(implementation details omitted) :

Input :

W	width of the sheet
H	height of the sheet
S_x	SlotScaleX calculated and defined above
S_y	SlotScaleY calculated and defined above
n	number of pages in the document
$P_{heights}$	array 1.... n of page Heights
P_{widths}	array 1.... n of page Widths

Output:

P_{scale}	array 1.... n of pageScales

Algorithm:

$$\forall i,\ i \in \{1,\ldots,n\}$$

$$P_{scale}[i] = f_{\min}(((W \times S_x)/P_{widths}[i]), ((H \times S_y)/P_{heights}[i]))$$

where $f_{\min}(a,b) = a,\ a \le b;$

$= b,\ b > a;$

return $\{P_{scale}\}$;

The determination of where the slots are on the sheet

To do this, first the left and then the top edge of the left top slot is calculated; the algorithm for both the edges follow the same pattern. At first, the position of either the middle slot or the middle gap is calculated depending on whether the number of columns(or rows for top edge) is odd or even (of course, the margins for the printer marks are deducted first from the sheet size). Then, the left(or top) edge is easily calculated by shifting that position by the required number of slot widths (or heights) and gaps to the left (or top). After the top-left position is calculated, calculation of all other positions is only a matter of shifting the position by correct number of slot sizes and gaps.

Pseudo code(implementation details omitted) :

Input :

W	width of the sheet
H	height of the sheet
M_l	the margins on the left (this includes the mark dimensions)
M_r	the margins on the right (including the mark dimensions)
M_t	the margins on the top(including the mark dimensions)
M_b	the margins on the bottom(including the mark dimensions)
n_r	number of rows
n_c	number of columns
G_v	array $1 \ldots n_c$ -1 of Vertical Gaps(Gaps between columns)
G_h	array $1 \ldots n_r$ -1 of Horizontal Gaps(Gaps between rows)
S_x	SlotScaleX calculated and defined above

S_y	SlotScaleY calculated and defined above
r	the row Number of the Slot
c	the column Number of the slot

Output :

p_l	left position of the slot
p_t	top position of the slot
p_r	right position of the slot
p_b	bottom position of the slot

Algorithm:

I = set of Integers.

$$p_l = M_l + f_{leftOdd}(W - M_l - M_r, W \times S_x, c, n_c, G_v) \quad ; \frac{n_c}{2} \in \mathbf{I} \ (n_c \text{ is odd})$$

$$= M_l + f_{leftEven}(W - M_l - M_r, W \times S_x, c, n_c, G_v) \quad ; \frac{n_c}{2} \in \mathbf{I} \ (n_c \text{ is even})$$

$$f_{leftOdd}(W_{sheet}, W_{slot}, c, n_c, G_v) = \left(\frac{W_{sheet}}{2} - \frac{W_{slot}}{2}\right) + \left(c - \left\lceil \frac{n_c}{2} \right\rceil\right) \times W_{slot} + f_{oddSumGaps}(c, n_c, G_v);$$

$$f_{oddSumGaps}(c, n_c, G_v) = -\sum_{i=\left\lceil \frac{n_c}{2} \right\rceil}^{i=c-1} G_v[i] \quad ; c > \left\lceil \frac{n_c}{2} \right\rceil$$

$$= 0 \quad ; c = \left\lceil \frac{n_c}{2} \right\rceil$$

$$= -\sum_{i=\sum_{c}^{\left\lceil \frac{n_c}{2} \right\rceil}}^{i=\left\lceil \frac{n_c}{2} \right\rceil - 1} G_v[i] \quad ; c < \left\lceil \frac{n_c}{2} \right\rceil$$

$$f_{leftEven}(W_{sheet}, W_{slot}, c, n_c, G_v) = \left(\frac{W_{sheet}}{2} - \frac{G_v[\frac{n_c}{2}]}{2}\right) - W_{slot} + \left(c - \frac{n_c}{2}\right) \times W_{slot} + f_{evenSumGaps}(c, n_c, G_v);$$

$$f_{evenSumGaps}(c, n_c, G_v) = \sum_{i=\frac{n_c}{2}}^{i=c-1} G_v[i] \quad ; c > \frac{n_c}{2}$$

$$= 0 \quad ; c = \frac{n_c}{2}$$

$$= -\sum_{i=c}^{i=\frac{n_c}{2}-1} G_v[i]; \; c < \frac{n_c}{2}$$

$$p_r = p_l + W \times S_x;$$

$$p_t = M_t + f_{topOdd}(H - M_t - M_b, H \times S_y, r, n_r, G_h); \; \frac{n_r}{2} \notin \mathbf{I} \; (n_r \text{ is odd})$$

$$= M_t + f_{topEven}(H - M_t - M_b, H \times S_y, r, n_r, G_h) \; ; \frac{n_r}{2} \in \mathbf{I} \; (n_r \text{ is even})$$

$$f_{topOdd}(H_{sheet}, H_{slot}, r, n_r, G_h) = \left(\frac{H_{sheet}}{2} - \frac{H_{slot}}{2}\right) + \left(r - \left\lceil \frac{n_r}{2} \right\rceil\right) \times H_{slot} + f_{oddSumGaps}(r, n_r, G_h);$$

$$f_{oddSumGaps}(r, n_r, G_h) = -\sum_{i=\left\lceil \frac{n_r}{2} \right\rceil}^{i=r-1} G_h[i] \quad ; r > \left\lceil \frac{n_r}{2} \right\rceil$$

$$= 0 \quad ; r = \left\lceil \frac{n_r}{2} \right\rceil$$

$$= -\sum_{i=r}^{i=\left\lceil \frac{n_r}{2} \right\rceil - 1} G_h[i] \quad ; r < \left\lceil \frac{n_r}{2} \right\rceil$$

$$f_{topEven}(H_{sheet}, H_{slot}, r, n_r, G_h) = \left(\frac{H_{sheet}}{2} - \frac{G_h[\frac{n_r}{2}]}{2}\right) - H_{slot} + \left(r - \frac{n_r}{2}\right) \times H_{slot} + f_{evenSumGaps}(r, n_r, G_h);$$

$$f_{evenSumGaps}(r, n_r, G_h) = \sum_{i=\frac{n_r}{2}}^{i=r-1} G_h[i] \quad ; r > \frac{n_r}{2}$$

$$= 0 \quad ; r = \frac{n_r}{2}$$

$$= -\sum_{i=r}^{i=\frac{n_r}{2}-1} G_h[i] \quad ; r < \frac{n_r}{2}$$

$$p_b = p_t + H \times S_y;$$

return $\{p_l, p_t, p_r, p_b\}$

The placement of pages within the slots.

Once the rectangles for the slots are calculated, one can easily place the pages inside those rectangles with appropriate pagescales. This scale is alterable by the user and hence the page can be clipped at slot edges. There is a freedom of movement of the pages within a slot and the correct position is determined by the imposition parameters like alignment(left, right, center) and offsets.

Figure 20 shows how this is done. The page is placed within the slot and then moved left, right, top or bottom according to the alignment. Figure 20 shows a randomly aligned page in a slot. It describes all the different possible movements of the page within the slot.

Although the invention is described herein with reference to a variety of preferred embodiments, one skilled in the art will readily appreciate that other applications may be substituted for those set forth herein without departing from the spirit and scope of the present invention. Accordingly, the invention should only be limited by the Claims included below.

CLAIMS

1. A method of imposing groups of printable pages, the pages varying in at least one of dimension and orientation, on printable sheets, comprising:

providing a representation of a printable sheet;

dividing said printable sheet representation into slots, each slot adapted to receive a printable page

assigning a printable page to each slot; and

setting at least one of alignment, offset and scaling, wherein said settings are applicable to one of a current slot, a row of slots, a column of slots and a sheet of slots.

2. The method of Claim 1, wherein said scaling settings include any of:

a 'scale to fit' mode;

a 'custom' mode;

a 'fit width mode'; and

a 'fit height' mode.

3. The method of Claim 1, further comprising rotating pages on said sheet in ninety degree increments.

4. The method of Claim 1, further comprising any of:

defining sheet size;

defining creep adjustment;

defining sheet orientation;

defining at least one of rows and columns;

defining printer's marks; and

defining finishing options.

5. The method of Claim 4, wherein defining printer's marks comprises:

defining trim marks; and

defining fold marks.

6. The method of Claim 5, wherein defining trim marks comprises:
defining horizontal and vertical length;
defining line type;
defining line width; and
defining line color.

7. The method of Claim 5, wherein defining fold marks comprises:
defining horizontal and vertical length;
defining line type;
defining line width; and
defining line color.

8. The method of Claim 4, wherein defining finishing options comprises:
defining binding options; and
defining options for ganged print jobs.

9. The method of Claim 1, further comprising any of:
adding sheets;
duplicating a sheet;
deleting a sheet; and
editing a page.

10. The method of Claim 1, further comprising saving imposition attributes to a template.

11. The method of Claim 1, further comprising specifying imposition attributes by applying a template.

12. The method of Claim 1, further comprising previewing said sheets.

13. The method of Claim 1, wherein previewing said sheets comprises any of:
editing any of said printable pages; and
setting gutter size.

14. A method for formatting printable information, comprising:

providing a plurality of data objects;

presenting said objects in a common format;

selecting at least some of said data objects;

ordering said selected data objects into a first sequence so that said ordered objects comprise a printable document, each object comprising a printable page, the printable pages either uniform in dimension and orientation or varying in at least one of dimension and orientation; and

imposing groups of said printable pages on printable sheets, such that a page sequence of a final printed document matches said first sequence after post-printing processing of sheets printed from said printable sheets.

15. The method of Claim 14, wherein said data objects comprise any of pages from digital documents and digital images, and wherein said common format comprises a common page description language.

16. The method of Claim 15, wherein said page description language comprises portable document format (PDF).

17. The method of Claim 14, wherein imposing groups of said printable pages comprises any of:

imposing a group of printable pages on each sheet; and

imposing a group of printable pages on each sheet, wherein the printable pages are of uniform dimension and orientation.

18. The method of Claim 17, wherein imposing a group of printable pages on each sheet comprises:

providing a representation of a printable sheet;

dividing said printable sheet representation into slots, each slot adapted to receive a printable page

assigning a printable page to each slot by placing a representation of said printable page in said slot; and

setting at least one of alignment, offset and scaling, wherein said settings are applicable to one of a current slot, a row of slots, a column of slots and a sheet of slots;

wherein said group of printable pages includes one of:

pages of uniform dimension and orientation; and

pages varying in at least one of dimension and orientation.

19. The method of Claim 18, wherein scaling settings include any of:

a 'scale to fit' mode;

a 'custom' mode;

a 'fit width' mode; and

a 'fit height' mode.

20. The method of Claim 18, further comprising rotating pages on said sheet in ninety degree increments.

21. The method of Claim 17, wherein imposing printable pages of uniform dimension comprises:

providing a representation of a printable sheet;

dividing said printable sheet representation into slots, each slot adapted to receive a printable page;

assigning a printable page to each slot; and

automatically setting alignment and offset and applying identical settings to each slot.

22. The method of Claim 21, further comprising setting scaling, wherein an identical setting is automatically applied to each slot.

23. The method of Claim 21, wherein said scaling settings include any of:

a 'scale to fit' mode; and

a custom mode.

24. The method of Claim 21, further comprising setting and defining bleeds.

25. The method of Claim 21, further comprising rotating pages on said sheet in one hundred eighty degree increments.

26. The method of Claim 17, further comprising any of:
defining sheet size;
defining creep adjustment;
defining sheet orientation;
defining at least one of rows and columns;
defining printer's marks; and
defining finishing options.

27. The method of Claim 26, wherein defining printer's marks comprises:
defining trim marks; and
defining fold marks.

28. The method of Claim 27, wherein defining trim marks comprises:
defining horizontal and vertical length;
defining line type;
defining line width; and
defining line color.

29. The method of Claim 27, wherein defining fold marks comprises:
defining horizontal and vertical length;
defining line type;
defining line width; and
defining line color.

30. The method of Claim 26, wherein defining finishing options comprises:
defining binding options; and
defining options for ganged print jobs.

31. The method of Claim 17, further comprising any of:
adding sheets;
duplicating a sheet;
deleting a sheet; and
editing a page.

32. The method of Claim 17, further comprising saving imposition attributes to a template.

33. The method of Claim 17, further comprising specifying imposition attributes by applying a template.

34. The method of Claim 14, further comprising previewing said sheets.

35. The method of Claim 34, wherein previewing said sheets comprises any of:
editing any of said printable pages; and
setting gutter size.

36. The method of Claim 14, further comprising printing said sheets.

37. The method of Claim 36, further comprising any of:
cutting said printed sheets;
folding said printed sheets;
collating printed pages cut from said printed sheets; and
binding said printed pages.

38. A system for formatting printable information, comprising:
at least one server;
at least one workstation connected to said server;
at least one output device connected to said server;
a plurality of data objects, the data objects stored on said server in a common format; and
computer-readable code means for:

selecting at least some of said data objects;

ordering said selected data objects into a first sequence so that said ordered objects comprise a printable document, each object comprising a printable page, the printable pages either uniform in dimension and orientation or varying in at least one of dimension and orientation; and

imposing groups of said printable pages on printable sheets, such that a page sequence of a final printed document matches said first sequence after post-printing processing of sheets printed from said printable sheets;

wherein the computer-readable code means is resident on said server.

39. The system of Claim 38, wherein a user accesses said objects and said computer-readable code means by means of a graphical user interface (GUI) resident on said workstation.

40. The system of Claim 38, wherein said data objects comprise any of pages from digital documents and digital images, and wherein said common format comprises a common page description language.

41. The system of Claim 40, wherein said page description language comprises portable document format (PDF).

42. The system of Claim 38, wherein the computer-readable code means for imposing groups of said printable pages comprises computer-readable code means for any of:

imposing a group of printable pages on each sheet; and

imposing a group of printable pages on each sheet, wherein the printable pages are of uniform dimension and orientation.

43. The system of Claim 42, wherein the computer-readable code means for imposing a group of printable pages on each sheet comprises computer-readable code means for:

providing a representation of a printable sheet;

dividing said printable sheet representation into slots, each slot adapted to receive a printable page;

assigning a printable page to each slot; and

setting at least one of alignment, offset and scaling, wherein said settings are applicable to one of a current slot, a row of slots, a column of slots and a sheet of slots;

wherein said group of printable pages includes one of: pages of uniform dimension and orientation and pages varying in at least one of dimension and orientation.

44. The system of Claim 43, wherein scaling settings include any of:

a 'scale to fit' mode;

a 'custom' mode;

a 'fit width' mode; and

a 'fit height' mode.

45. The system of Claim 42, further comprising computer-readable code means for rotating pages on said sheet in ninety degree increments.

46. The system of Claim 42, wherein the computer-readable code means for imposing printable pages of uniform dimension comprises computer-readable code means for:

providing a representation of a printable sheet;

dividing said printable sheet representation into slots, each slot adapted to receive a printable page;

assigning a printable page to each slot by placing a representation of said printable page in said slot; and

automatically setting alignment and offset and applying identical settings to each slot.

47. The system of Claim 46, further comprising computer-readable code means for setting scaling, wherein an identical setting is automatically applied to each slot.

48. The system of Claim 46, wherein said scaling settings include any of:

a 'scale to fit' mode; and

a custom mode.

49. The system of Claim 46, further comprising computer-readable code means for setting and defining bleeds.

50. The system of Claim 46, further comprising computer-readable code means for rotating pages on said sheet in one hundred eighty degree increments.

51. The system of Claim 42, further comprising computer-readable code means for any of:

defining sheet size;

defining creep adjustment;

defining sheet orientation;

defining at least one of rows and columns;

defining printer's marks; and

defining finishing options.

52. The system of Claim 51, wherein the computer-readable code means for defining printer's marks comprises computer-readable code means for:

defining trim marks; and

defining fold marks.

53. The system of Claim 52, wherein the computer-readable code means for defining trim marks comprises computer-readable code means for:

defining horizontal and vertical length;

defining line type;

defining line width; and

defining line color.

54. The system of Claim 52, wherein the computer-readable code means for defining fold marks comprises computer-readable code means for:

defining horizontal and vertical length;

defining line type;

defining line width; and

defining line color.

55. The system of Claim 51, wherein said computer-readable code means for defining finishing options comprises computer-readable code means for:

defining binding options; and

defining options for ganged print jobs.

56. The system of Claim 51, further comprising computer-readable code means for any of:

adding sheets;

duplicating a sheet;

deleting a sheet; and

editing a page.

57. The system of Claim 51, further comprising computer-readable code means for saving imposition attributes to a template.

58. The system of Claim 51, further comprising computer-readable code means for specifying imposition attributes by applying a template.

59. The system of Claim 38, further comprising computer-readable code means for previewing said sheets.

60. The system of Claim 59, wherein said computer-readable code means for previewing said sheets comprises computer-readable code means for any of:

editing any of said printable pages; and

setting gutter size.

61. The system of Claim 38, further comprising computer-readable code means for printing said sheets from said output device.

62. The system of Claim 61, further comprising computer-readable code means for any of:

cutting said printed sheets;

folding said printed sheets;

collating printed pages cut from said printed sheets;

binding said printed pages; and

stapling said printed pages.

5

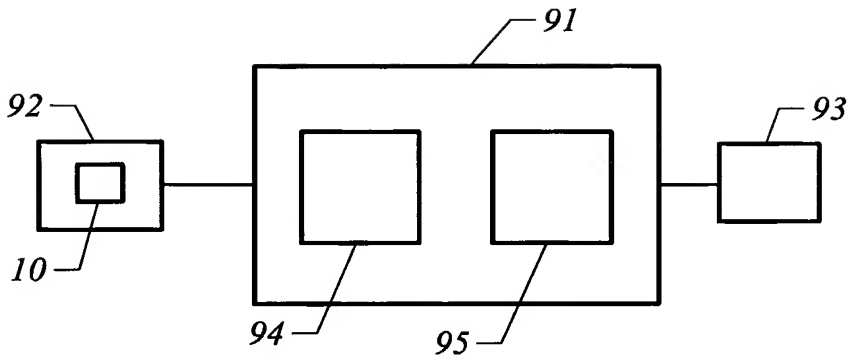


FIG. 1

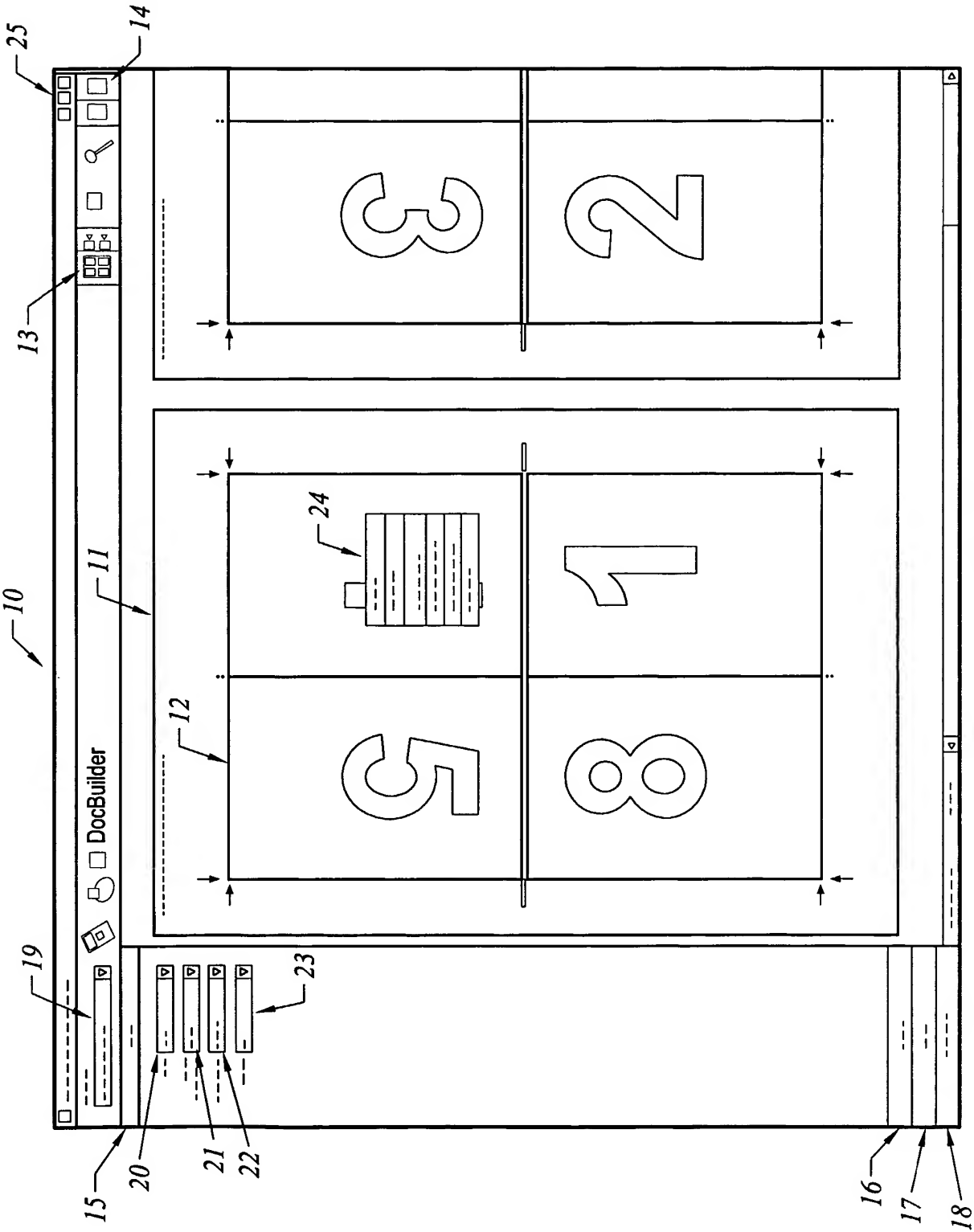


FIG. 2

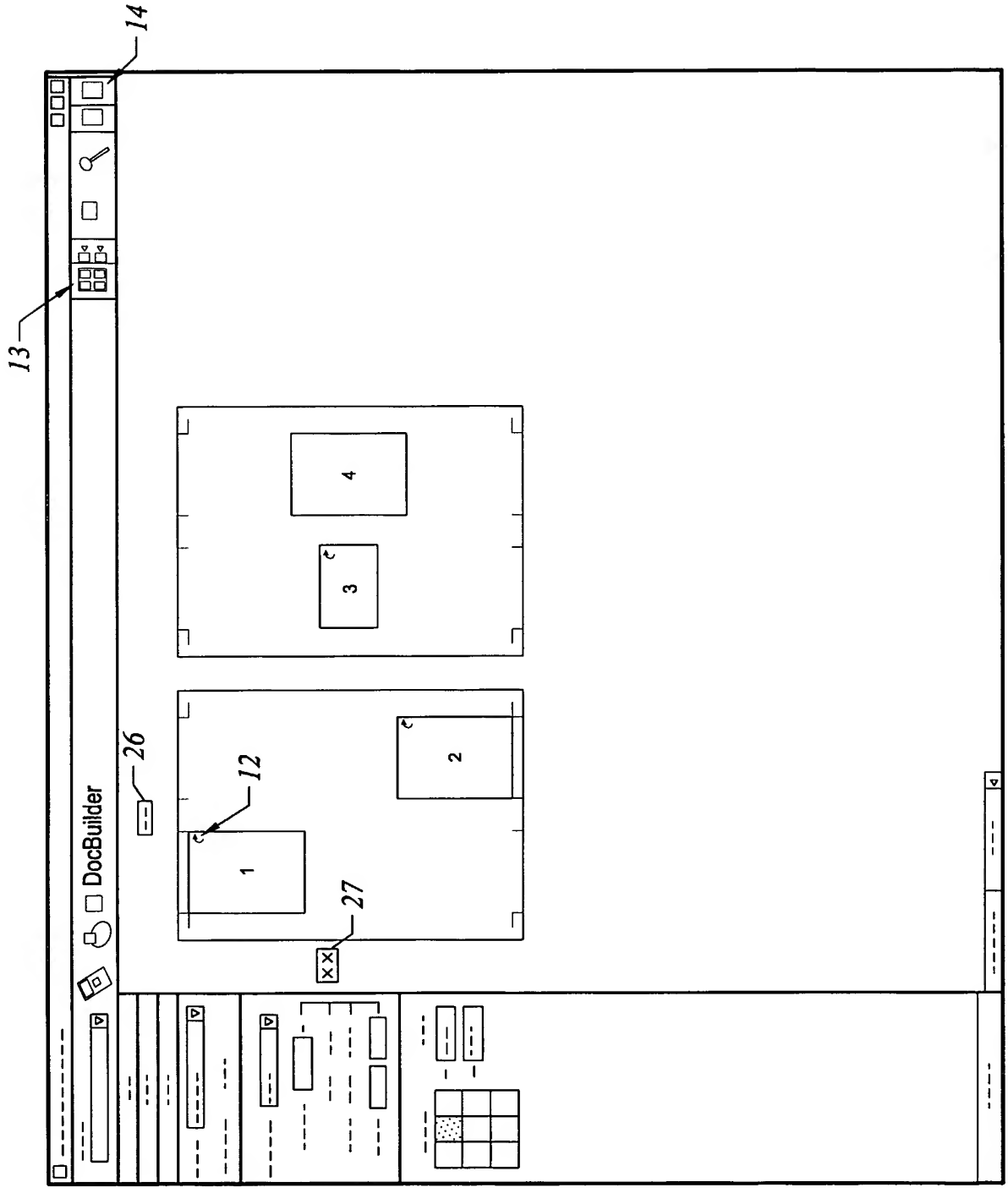


FIG. 3

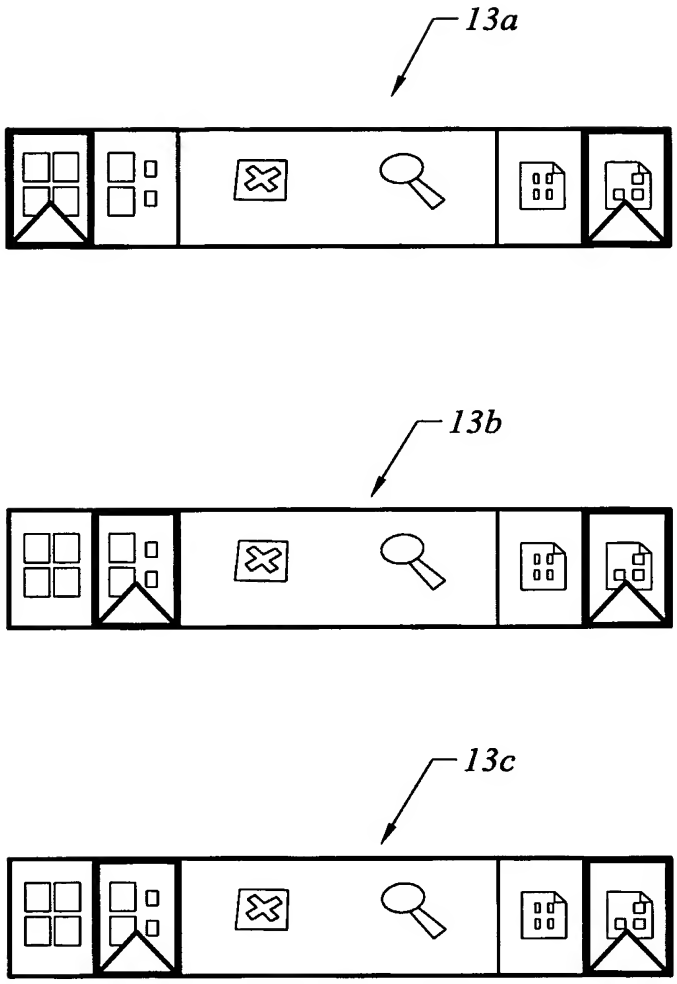


FIG. 4

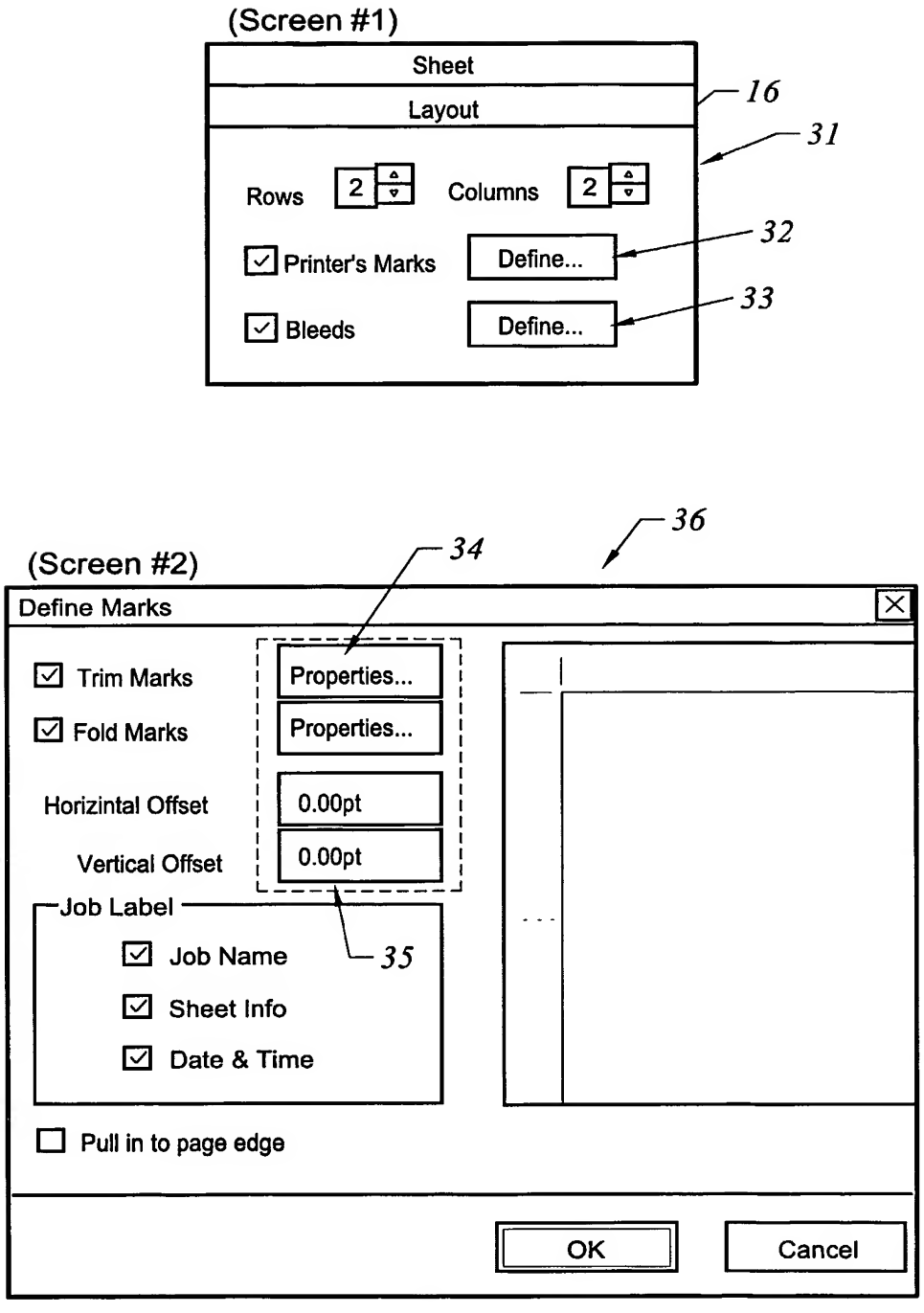

(Screen #1)
Sheet
Layout
16
31
Rows
2
Columns
2
Printer's Marks
Define...
32
Bleeds
Define...
33
(Screen #2)
36
34
Define Marks
Trim Marks
Properties...
Fold Marks
Properties...
Horizintal Offset
0.00pt
Vertical Offset
0.00pt
Job Label
Job Name
35
Sheet Info
Date & Time
Pull in to page edge
OK
Cancel

FIG. 5

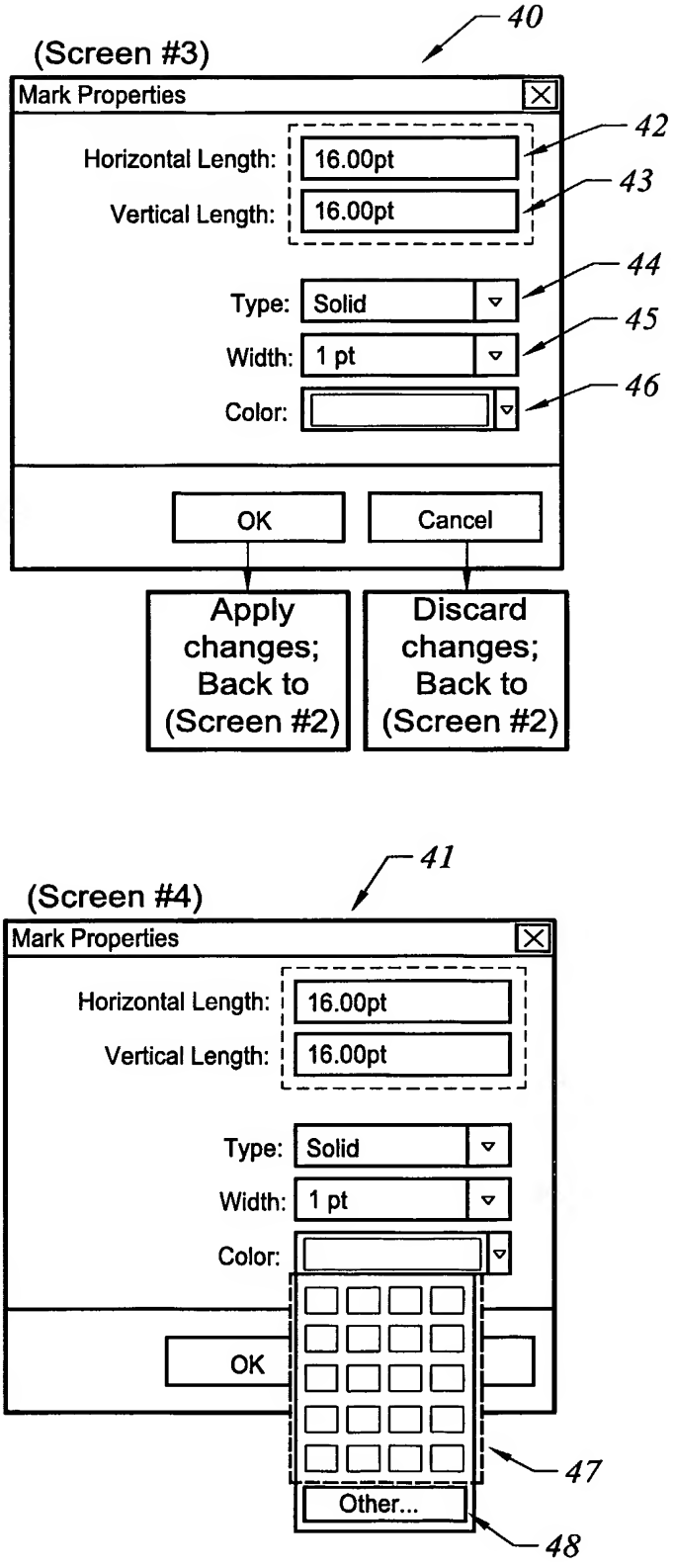

40
(Screen #3)
Mark Properties
Horizontal Length:
16.00pt
Vertical Length:
16.00pt
42
43
Type:
Solid
Width:
1 pt
Color:
44
45
46
OK
Cancel
Apply changes; Back to (Screen #2)
Discard changes; Back to (Screen #2)
41
(Screen #4)
Mark Properties
Horizontal Length:
16.00pt
Vertical Length:
16.00pt
Type:
Solid
Width:
1 pt
Color:
OK
Other...
47
48

FIG. 6

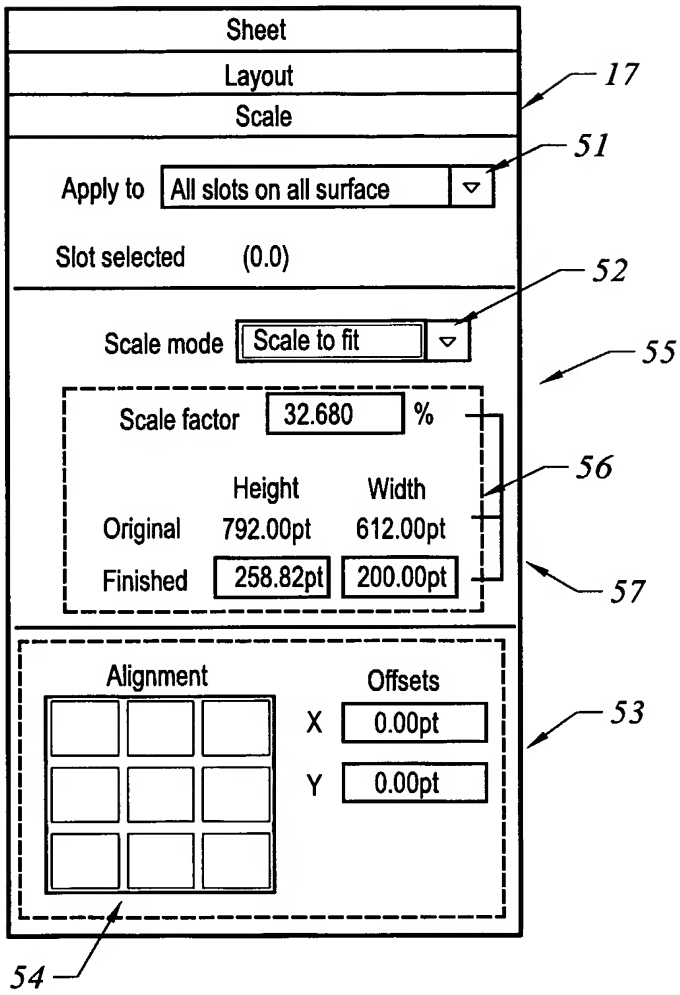

Sheet
Layout
Scale
17
51
Apply to
All slots on all surface
Slot selected
(0.0)
52
Scale mode
Scale to fit
55
Scale factor
32.680
%
56
Height
Width
Original
792.00pt
612.00pt
Finished
258.82pt
200.00pt
57
Alignment
Offsets
X
0.00pt
Y
0.00pt
53
54

FIG. 7

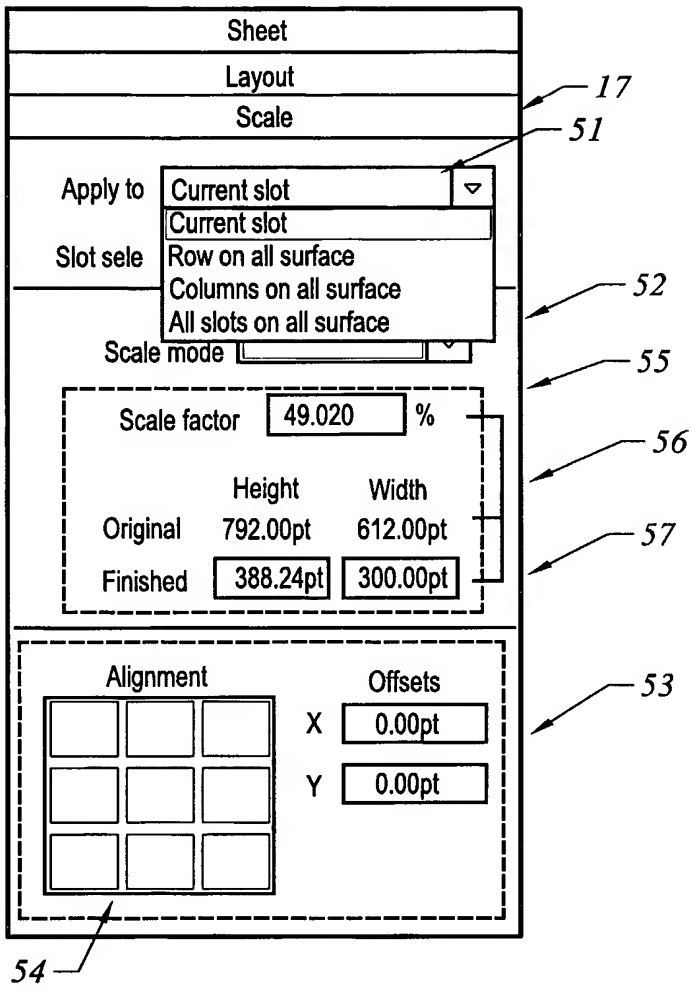

Sheet
Layout
Scale
17
51
Apply to
Current slot
Current slot
Slot sele
Row on all surface
Columns on all surface
All slots on all surface
52
Scale mode
55
Scale factor
49.020
%
56
Height
Width
Original
792.00pt
612.00pt
57
Finished
388.24pt
300.00pt
Alignment
Offsets
53
X
0.00pt
Y
0.00pt
54

FIG. 8

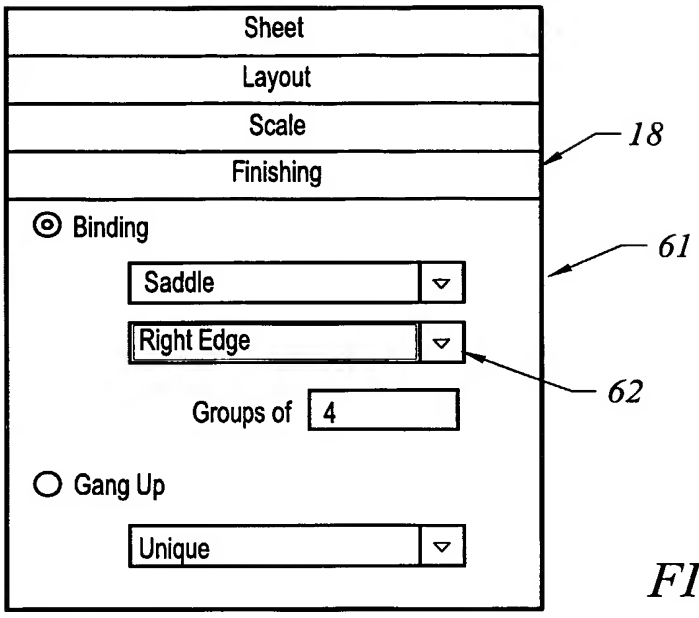

Sheet
Layout
Scale
Finishing
18
Binding
61
Saddle
Right Edge
62
Groups of 4
Gang Up
Unique

FIG. 9A

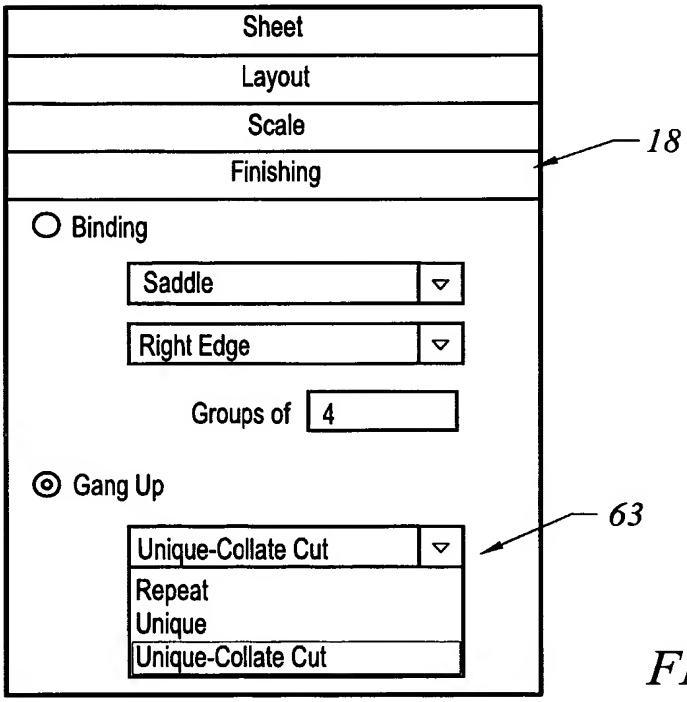

Sheet
Layout
Scale
Finishing
18
Binding
Saddle
Right Edge
Groups of 4
Gang Up
63
Unique-Collate Cut
Repeat
Unique
Unique-Collate Cut

FIG. 9B

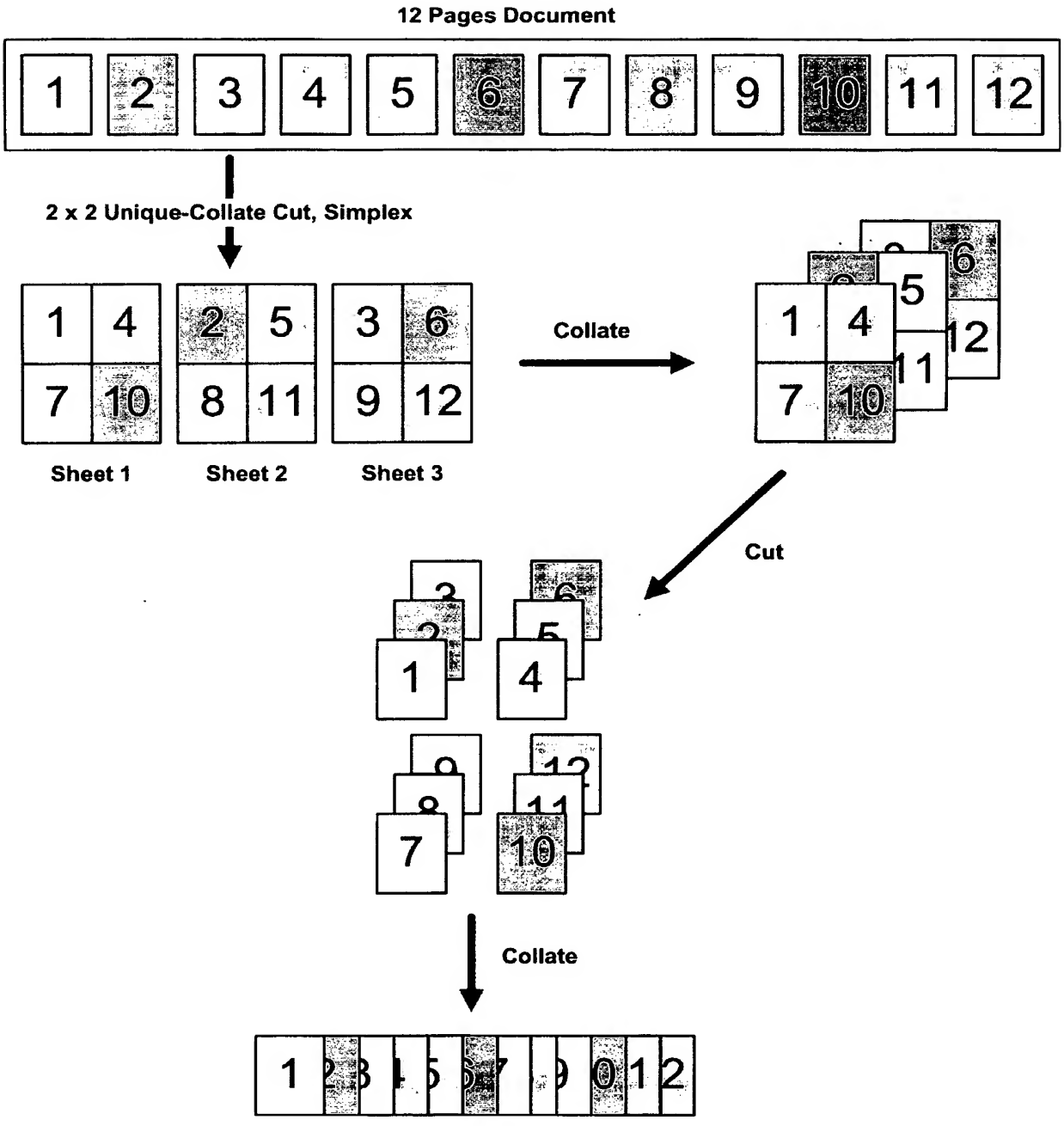

12 Pages Document
1 2 3 4 5 6 7 8 9 10 11 12
2 x 2 Unique-Collate Cut, Simplex
1 4 7 10
2 5 8 11
3 6 9 12
Sheet 1
Sheet 2
Sheet 3
Collate
Cut
Collate

FIG. 10

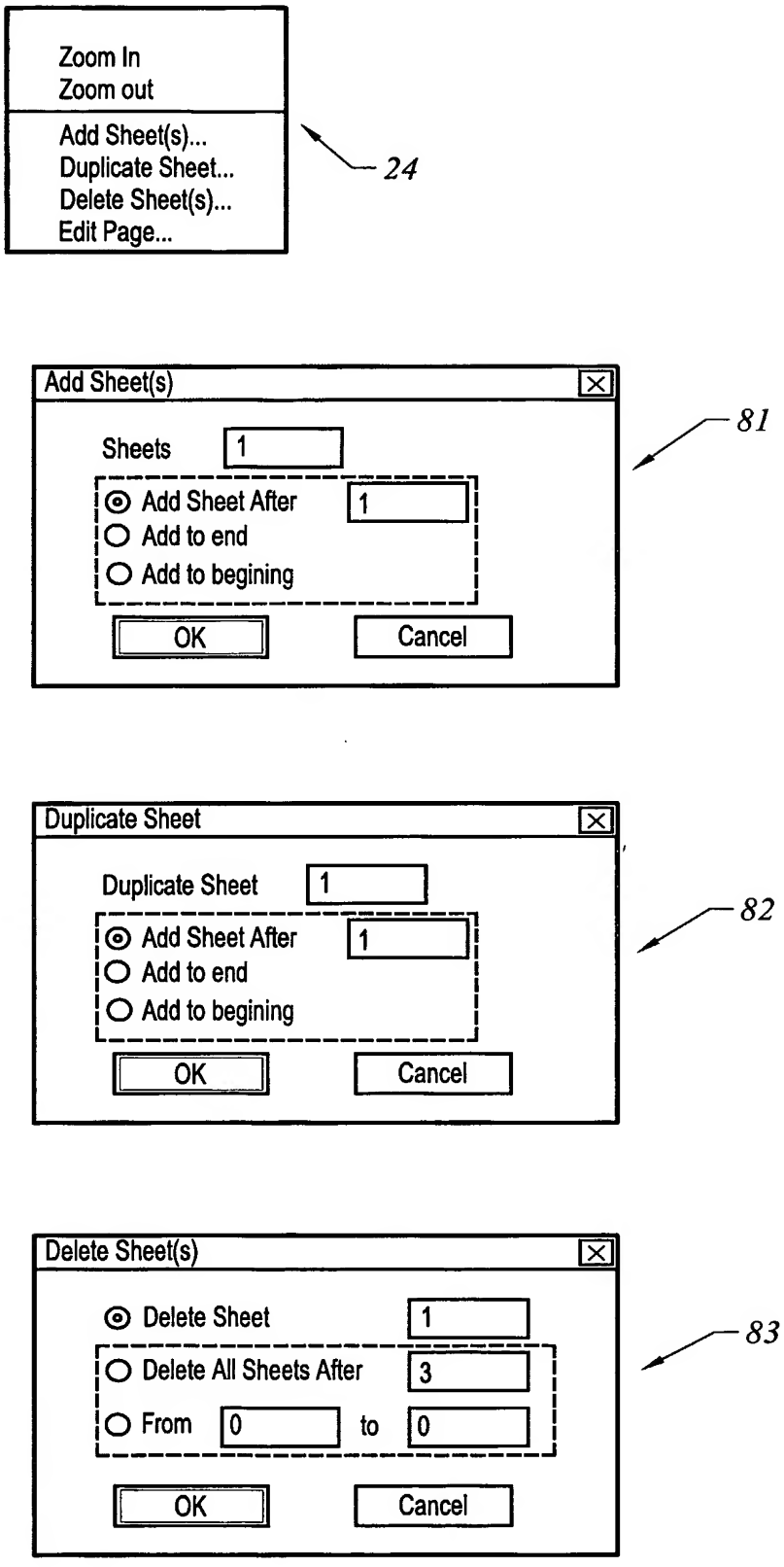

Zoom In
Zoom out
Add Sheet(s)...
Duplicate Sheet...
Delete Sheet(s)...
Edit Page...
24
Add Sheet(s)
Sheets 1
Add Sheet After 1
Add to end
Add to begining
OK
Cancel
81
Duplicate Sheet
Duplicate Sheet 1
Add Sheet After 1
Add to end
Add to begining
OK
Cancel
82
Delete Sheet(s)
Delete Sheet 1
Delete All Sheets After 3
From 0 to 0
OK
Cancel
83

FIG. 11

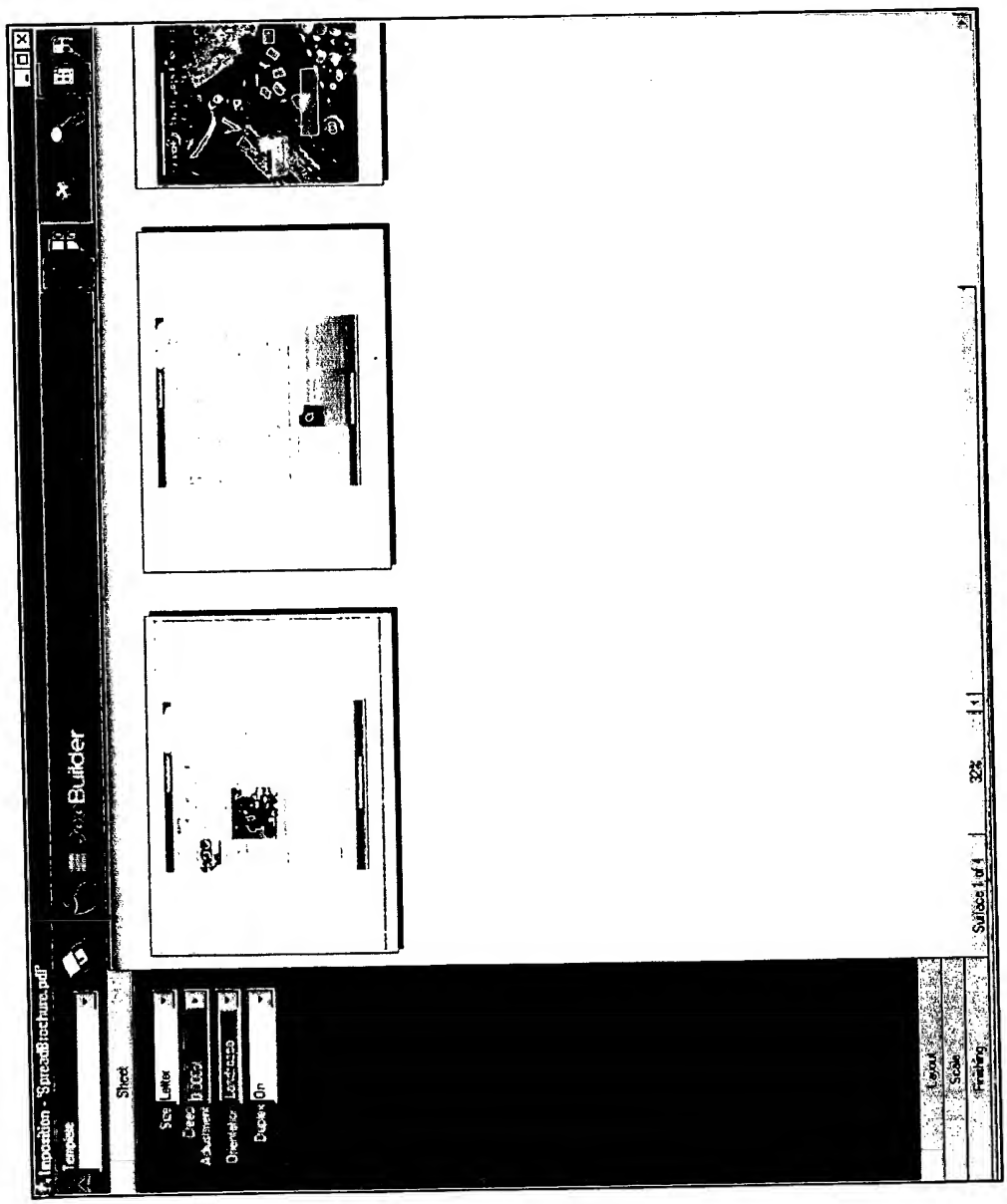

Imposition - SpreadBrochure.pdf
Template
Sheet
Size
Letter
Orientation
Landscape
Duplex
On
Layout
Sides
Finishing
Surface 1 of 1
32%
1:1

FIG. 12

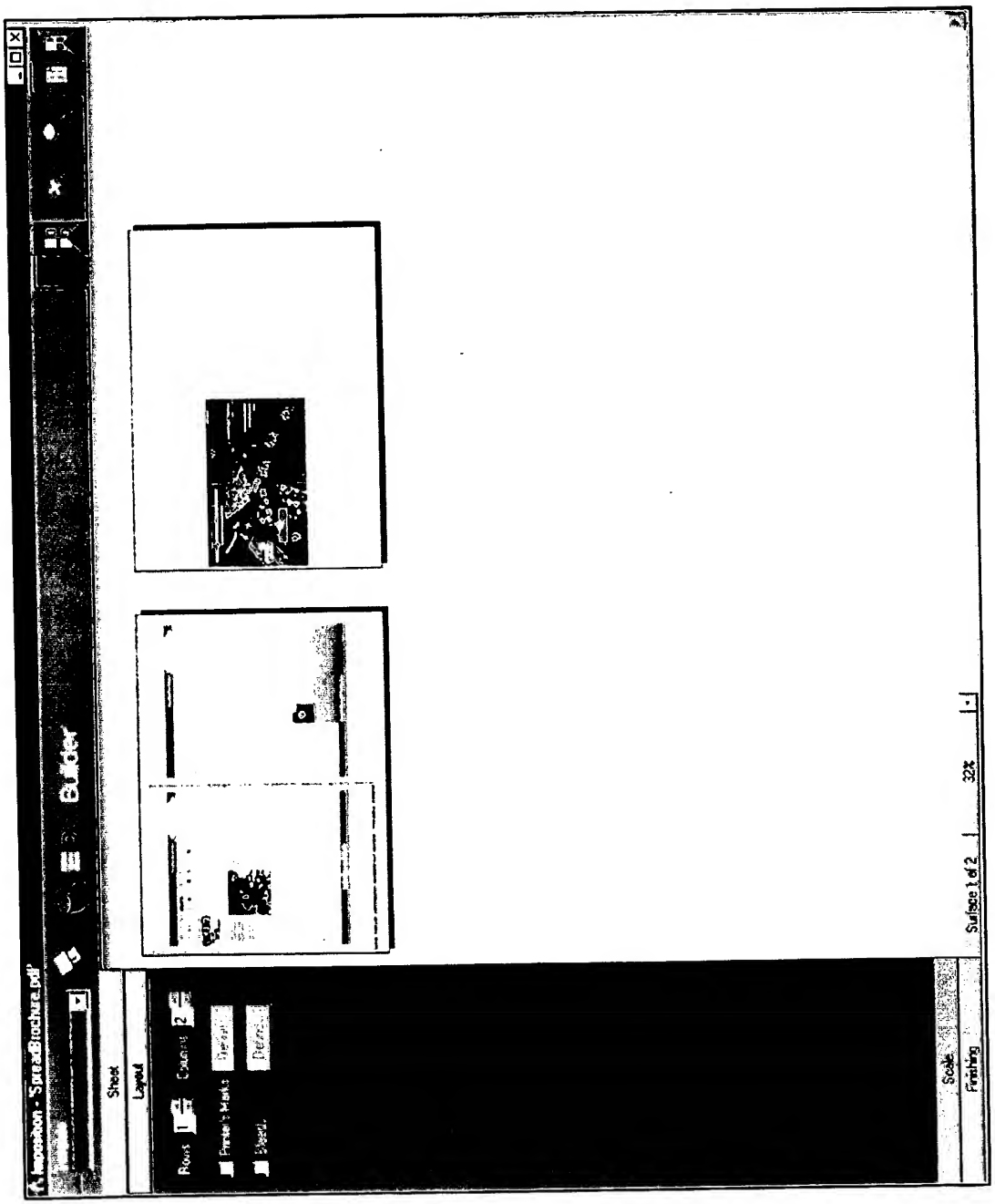


FIG. 13

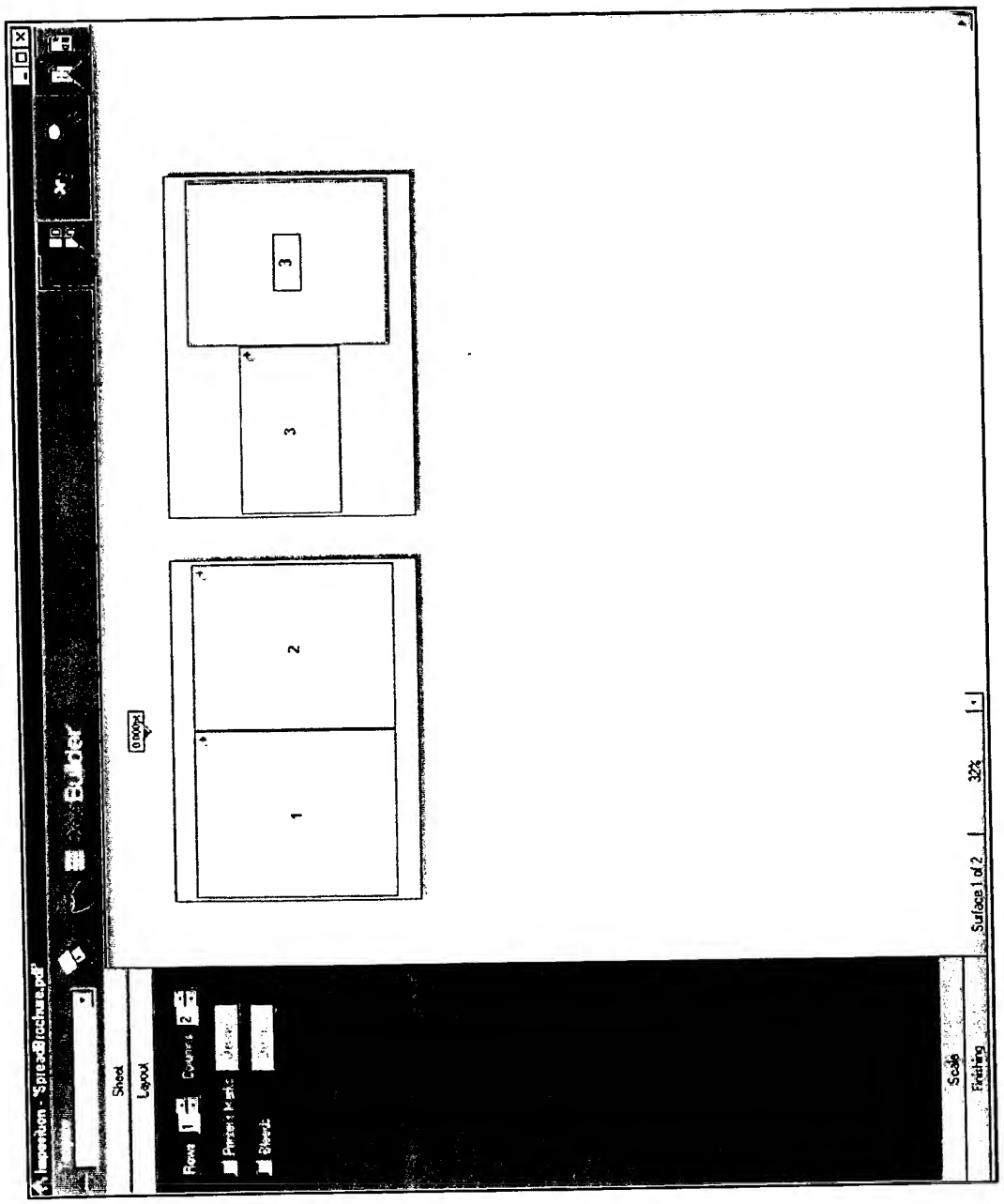

Builder
Sheet
Layout
Rows
Columns
Bleeds
Scale
Finishing
Surface 1 of 2
32%
1
2
3
3

FIG. 14

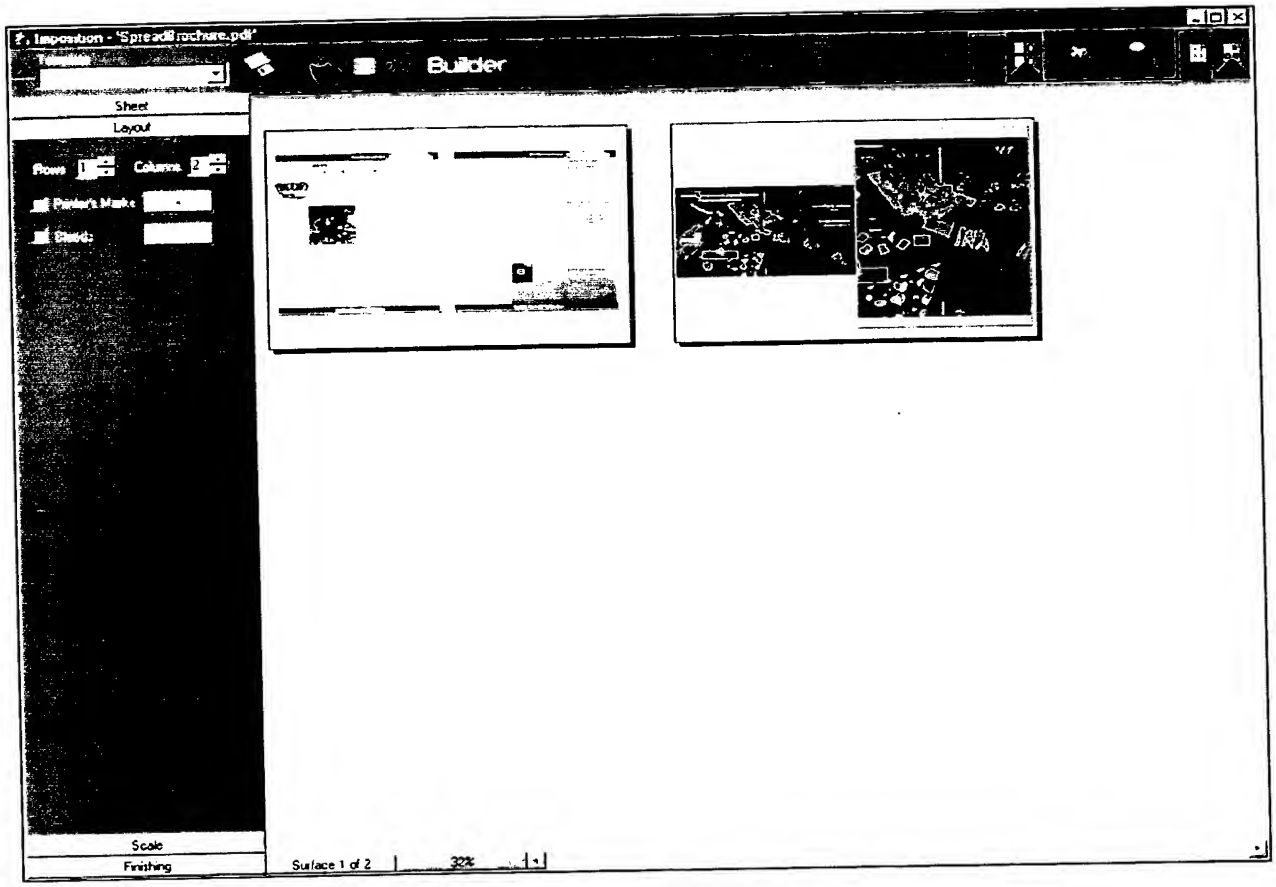

Builder
Sheet
Layout
Rows
Columns
Scale
Finishing
Surface 1 of 2
32%

FIG. 15

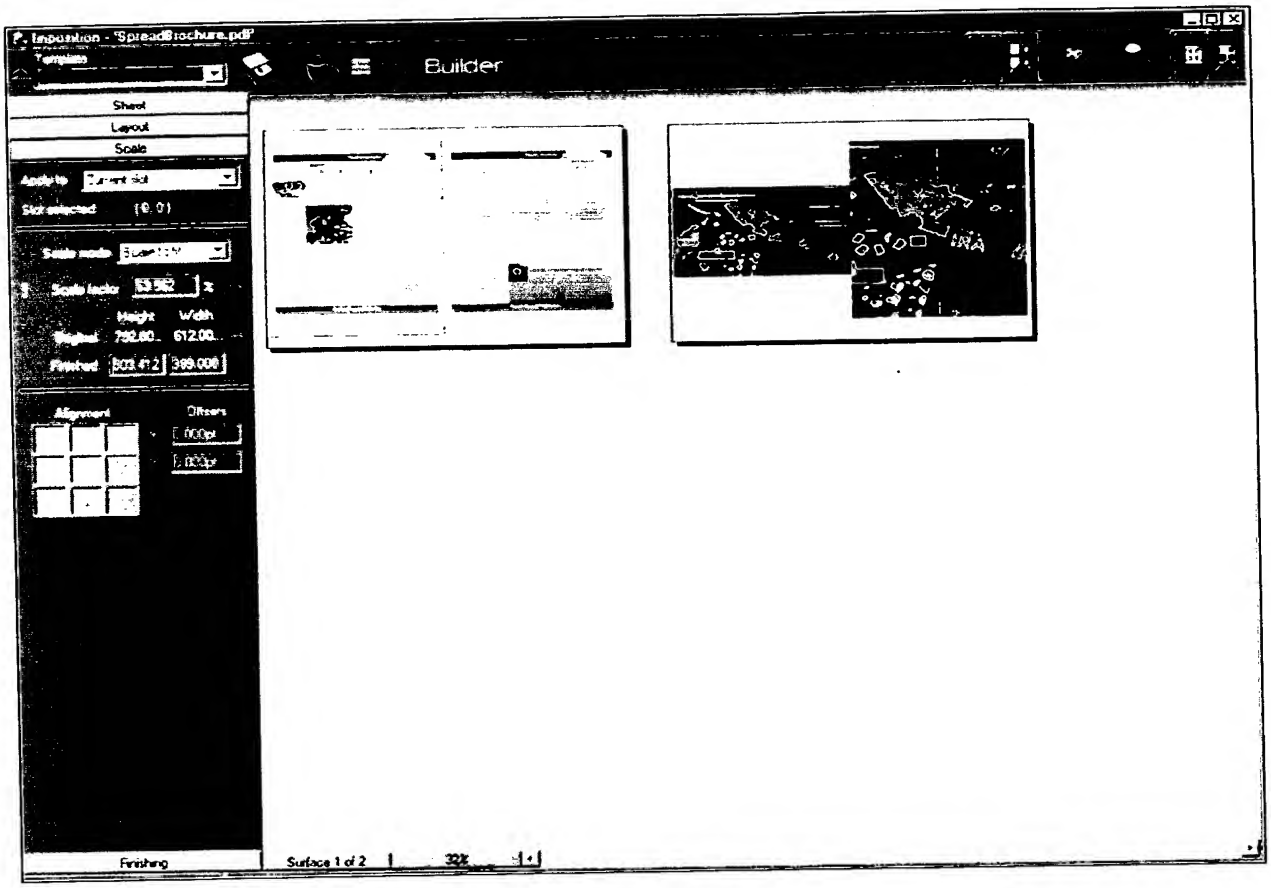


FIG. 16

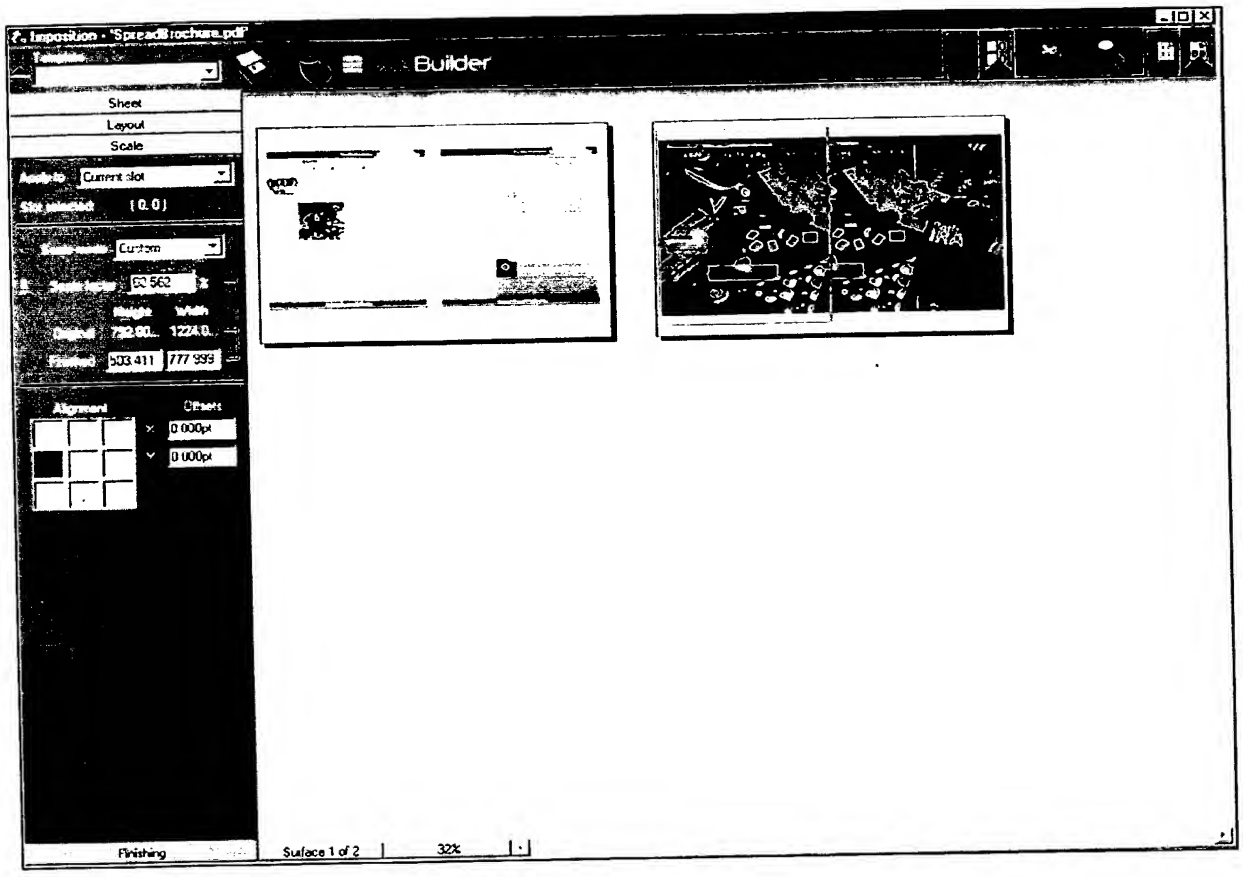

Builder
Sheet
Layout
Scale
Current slot
Custom
Alignment
Offsets
Finishing
Surface 1 of 2
32%

FIG. 17

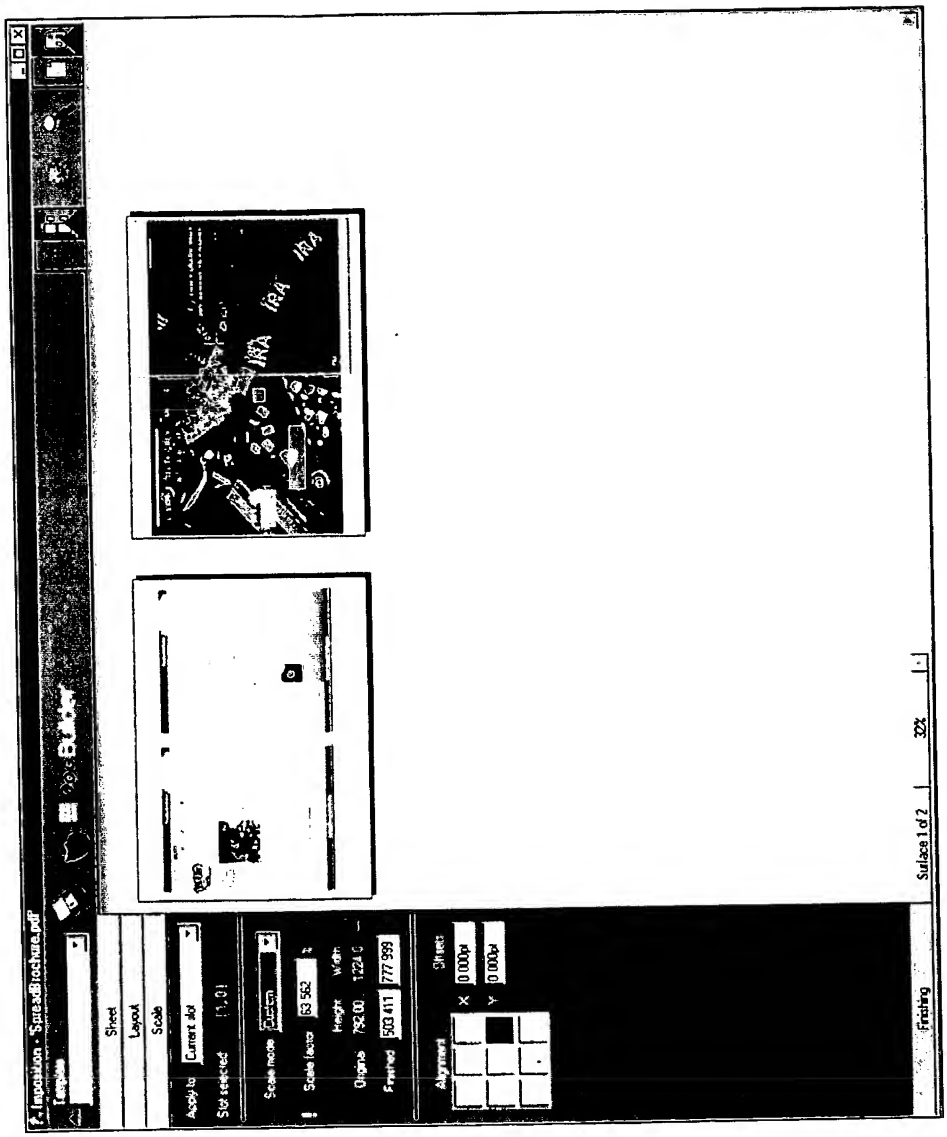

Sheet
Layout
Scale
Apply to
Current plot
Slot selected
Scale mode
Custom
Scale factor
63.562
Height
Width
Original
792.00
1224.0
Finished
503.411
777.999
Alignment
Sheet
0.000pt
0.000pt
Surface 1 of 2
32%
Finishing

FIG. 18

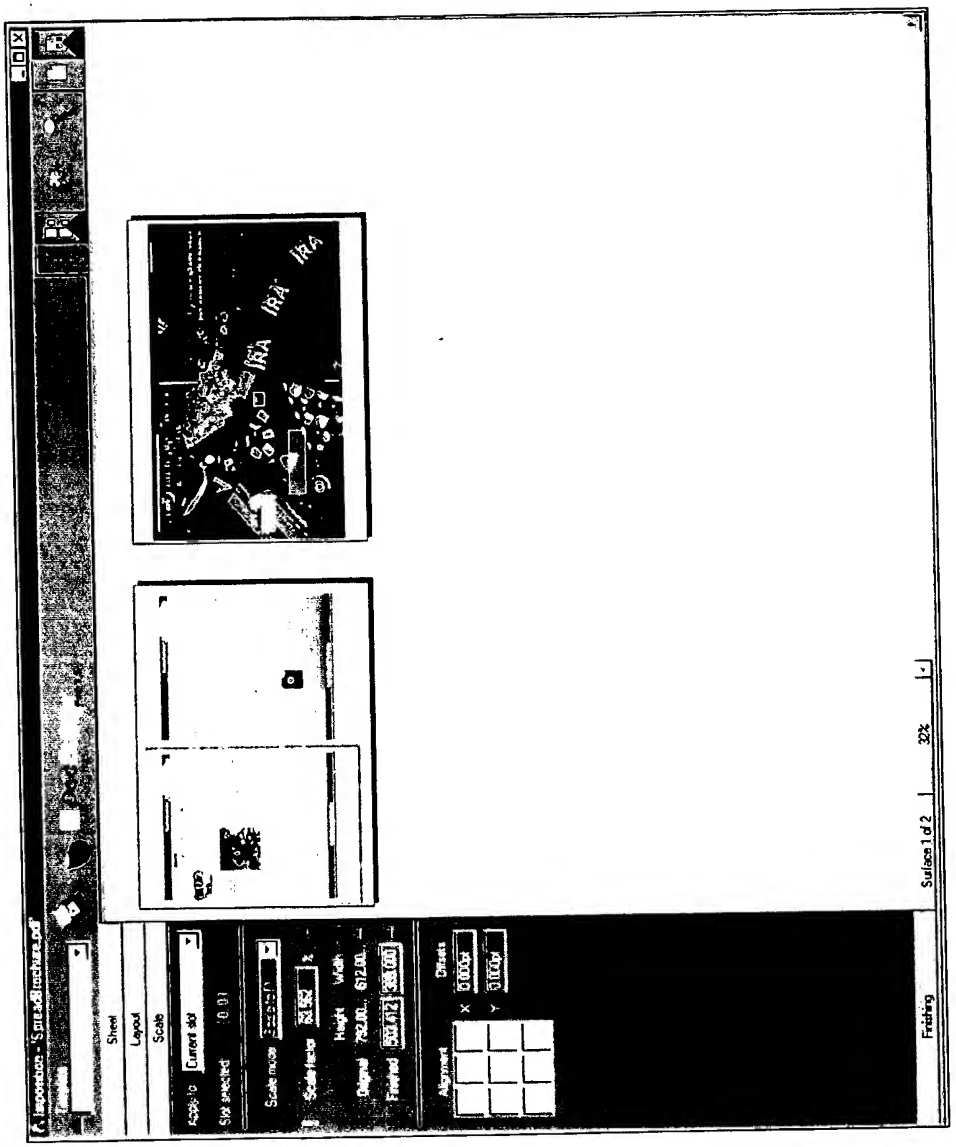

Sheet
Layout
Scale
Apply to
Current slot
Slot selected
Scale mode
Scale factor
Height
Width
Original
Finished
Alignment
Offsets
Finishing
Surface 1 of 2
32%

FIG. 19

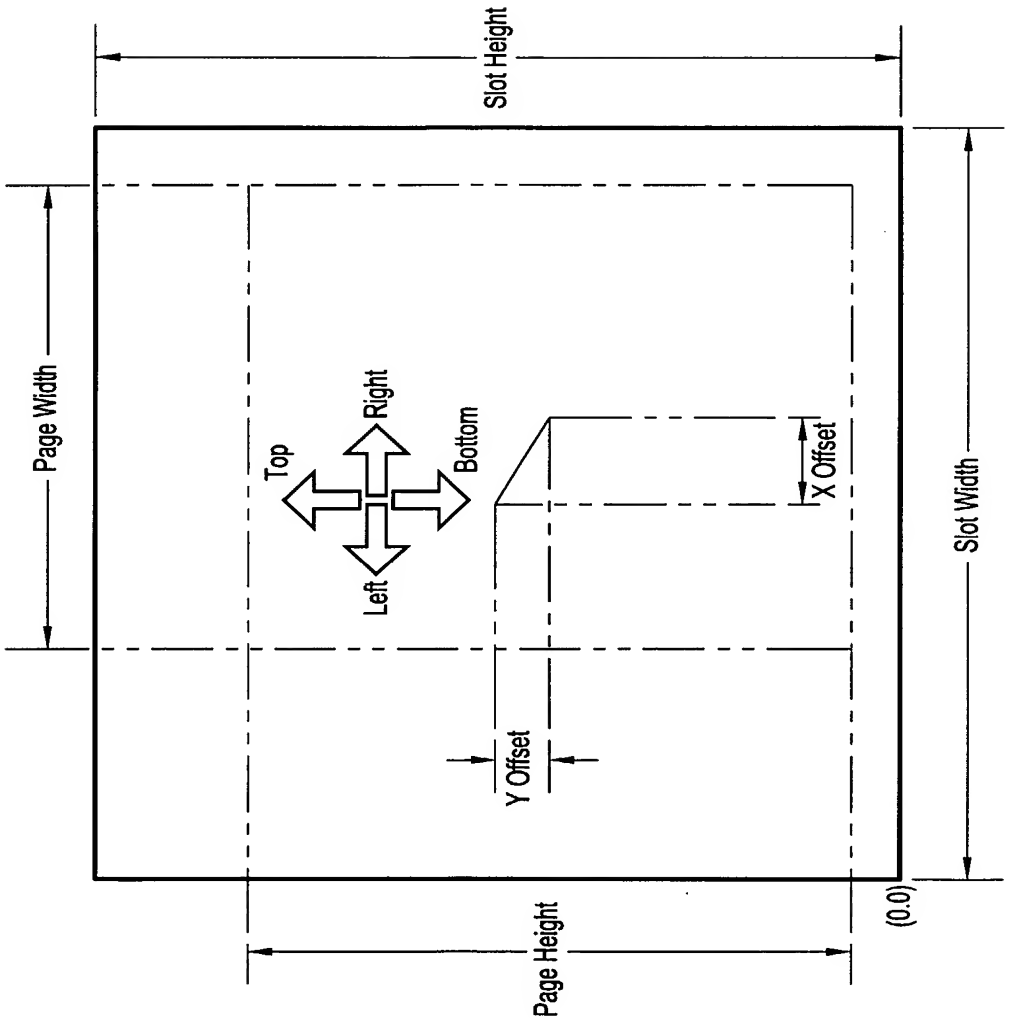

Slot Height
Page Width
Slot Width
Top
Right
Bottom
Left
X Offset
Y Offset
Page Height
(0.0)

FIG. 20

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 October 2002 (24.10.2002)

PCT

(10) International Publication Number
WO 02/084582 A3

(51) International Patent Classification[7]: G06F 17/21

(21) International Application Number: PCT/US02/11201

(22) International Filing Date: 9 April 2002 (09.04.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/283,816 13 April 2001 (13.04.2001) US
10/047,505 26 October 2001 (26.10.2001) US

(71) Applicant: ELECTRONICS FOR IMAGING, INC. [US/US]; 303 Velocity Way, Foster City, CA 94404 (US).

(72) Inventors: GOEL, Puneet; 732 Marlin Avenue, Apt. 3, Foster City, CA 94404 (US). TANDON, Vivek; 465 Stierlin Road, Apt. 18, Mountain View, CA 94043 (US).

(74) Agent: TROSINO, James; 268 Bush Street, #3434, San Francisco, CA 94104 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

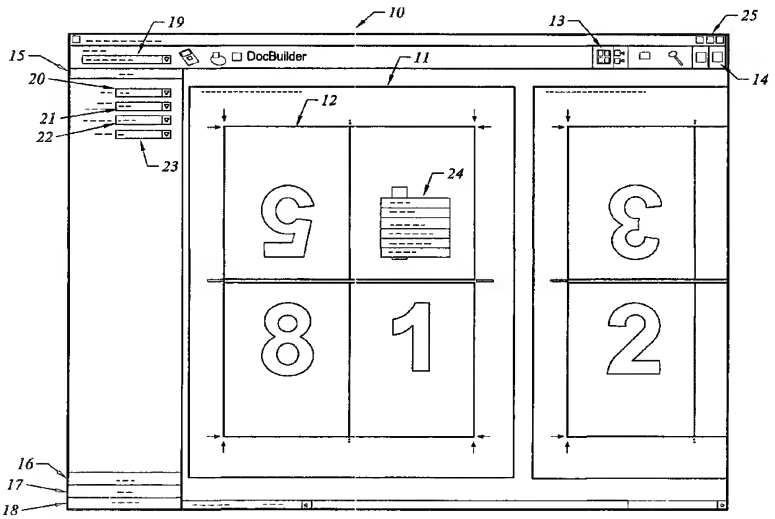
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
13 November 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PROCESS AND SYSTEM FOR MIXED PAGE IMPOSITION



(57) Abstract: A process for formatting printable information orders selected data objects, document pages or images, to create a new document, where pages may be of uniform dimension and page orientation or varying in one or both of dimension and page orientation. Groups of pages are imposed on sheets so that the sequence of the printed pages matches the page sequence of the created document after post-printing processing. A method of imposing the differently shaped and sized printable pages on sheets divides an image of a sheet into separate slots and places a page into each slot by placing an image of the page in each slot. Alignment, offset and scaling settings are applied to individual slots, rows, columns or all slots. A variety of other layout and job options are set before printing. In a distributed system, the software, accessible from any workstation, is housed on a server.

WO 02/084582 A3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/11201

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/21

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F H04N G06T G03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, IBM-TDB, EPO-Internal, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 495 563 A (SCITEX CORP LTD) 22 July 1992 (1992-07-22)	1,14
A	page 5, line 57 -page 11, line 24	2-13, 15-37
X	EP 0 887 746 A (ADOBE SYSTEMS INC) 30 December 1998 (1998-12-30)	1,14
A	column 5, line 18 -column 11, line 55; figure 4	2-13, 15-37
A	EP 0 330 343 A (DIGITAL EQUIPMENT CORP) 30 August 1989 (1989-08-30) column 5, line 35 -column 16, line 25; figures 5-7	1-37

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 August 2003	05. 09. 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bowler, A

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/11201

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 03, 31 March 1999 (1999-03-31) & JP 10 333314 A (DAINIPPON SCREEN MFG CO LTD), 18 December 1998 (1998-12-18) abstract	1,9,14, 17,31,36
Y	US 5 988 899 A (BENSON CRAIG H ET AL) 23 November 1999 (1999-11-23) column 1, line 5 -column 8, line 27	38-62
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 02/11201

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. [X] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

[X] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-37

   A method for imposing groups of printable pages on printable sheets.

2. Claims: 38-62

   An object oriented client server system for formatting printable information. The system claimed in claim 38 includes computer code for ordering selected data objects into a sequence for printing a document.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 02/11201

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter[redacted]onal Application No
PCT/US 02/11201

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		EP 0905647 A2	31-03-1999
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(43) International Publication Date
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(51) International Patent Classification[7]: G06F 17/21

(21) International Application Number:
PCT/US2002/011201

(22) International Filing Date: 9 April 2002 (09.04.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/283,816 13 April 2001 (13.04.2001) US
10/047,505 26 October 2001 (26.10.2001) US

(71) Applicant: **ELECTRONICS FOR IMAGING, INC.** [US/US]; 303 Velocity Way, Foster City, CA 94404 (US).

(72) Inventors: **GOEL, Puneet**; 732 Marlin Avenue, Apt. 3, Foster City, CA 94404 (US). **TANDON, Vivek**; 465 Stierlin Road, Apt. 18, Mountain View, CA 94043 (US).

(74) Agent: **TROSINO, James**; 268 Bush Street, #3434, San Francisco, CA 94104 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

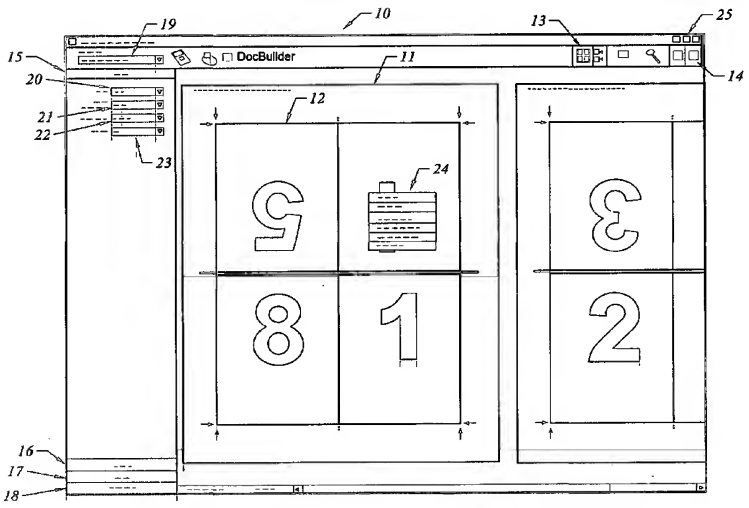
Published:
— *with international search report*

(88) Date of publication of the international search report:
13 November 2003

Date of publication of the revised international search report:
29 January 2004

[Continued on next page]

(54) Title: PROCESS AND SYSTEM FOR MIXED PAGE IMPOSITION



(57) Abstract: A process for formatting printable information orders selected data objects, document pages or images, to create a new document, where pages may be of uniform dimension and page orientation or varying in one or both of dimension and page orientation. Groups of pages are imposed on sheets so that the sequence of the printed pages matches the page sequence of the created document after post-printing processing. A method of imposing the differently shaped and sized printable pages on sheets divides an image of a sheet into separate slots and places a page into each slot by placing an image of the page in each slot. Alignment, offset and scaling settings are applied to individual slots, rows, columns or all slots. A variety of other layout and job options are set before printing. In a distributed system, the software, accessible from any workstation, is housed on a server.

WO 2002/084582 A3

(15) Information about Correction:
see PCT Gazette No. 05/2004 of 29 January 2004, Section II

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/11201

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/21

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F H04N G06T G03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, IBM-TDB, EPO-Internal, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 495 563 A (SCITEX CORP LTD) 22 July 1992 (1992-07-22) page 5, line 57 -page 11, line 24	1,14 2-13, 15-37
X A	EP 0 887 746 A (ADOBE SYSTEMS INC) 30 December 1998 (1998-12-30) column 5, line 18 -column 11, line 55; figure 4	1,14 2-13, 15-37
A	EP 0 330 343 A (DIGITAL EQUIPMENT CORP) 30 August 1989 (1989-08-30) column 5, line 35 -column 16, line 25; figures 5-7	1-37

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents:

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"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 August 2003	31. 10. 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bowler, A

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/11201

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 03, 31 March 1999 (1999-03-31) & JP 10 333314 A (DAINIPPON SCREEN MFG CO LTD), 18 December 1998 (1998-12-18) abstract	1,9,14, 17,31,36
Y	US 5 988 899 A (BENSON CRAIG H ET AL) 23 November 1999 (1999-11-23) column 1, line 5 -column 8, line 27	38-62
Y	US 5 809 218 A (GAHLER ARNO ET AL) 15 September 1998 (1998-09-15) column 2, line 7 -column 3, line 65; figure 3	38-62
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 02/11201

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-37

   A method for imposing groups of printable pages on printable sheets.

2. Claims: 38-62

   An object oriented client server system for formatting printable information. The system claimed in claim 38 includes computer code for ordering selected data objects into a sequence for printing a document.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 02/11201

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